

# MONTHLY WEATHER REVIEW,

JUNE, 1881.

(General Weather Service of the United States.)

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WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

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## INTRODUCTION.

In preparing this REVIEW the following data, received up to July 20th, have been used, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 133 Signal Service stations and 15 Canadian stations, as telegraphed to this office; 195 monthly journals and 167 monthly means from the former, and 15 monthly means from the latter; 199 monthly registers from Voluntary Observers; 56 monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; monthly reports from the local Weather Services of Iowa, Nebraska and Missouri, and of the Central Pacific Railway Co.; reliable newspaper extracts; special reports.

## BAROMETRIC PRESSURE.

The distribution of mean atmospheric pressure over the United States and Canada for the month of June, 1881, is shown by isobaric lines (in black) upon chart No. II. The region of the area of low, which was changed during the month of May from the Canadian Maritime Provinces to the Missouri valley, still remains over the latter district, but with a more decided and extensive depression. The pressure over the former district has fallen very decidedly, forming an area of 29.85, which with that over the Missouri valley makes two areas of low for the present month. For the same latitudes the pressure is very evenly distributed over the country east of the 100th meridian, but it is generally low, the highest, 30.00, being reported from only two stations—Cedar Keys and Port Eads—and the lowest, 29.83, at Chatham and 29.84 at Moorhead. There are two areas of comparatively high pressure, one covering the Gulf coast and the other the North Pacific coast. Compared with the preceding month, the pressure is everywhere lower except over the Florida Peninsula, where there is a slight rise. The greatest change is shown over the Canadian Maritime Provinces, where a fall of 0.16 to 0.25 inch is reported.

*Departures from the Normal Values for the Month.*—The pressure is below the mean at all stations, except in the northern portion of the Upper Lakes. Along the Atlantic coast the departures increase from  $-0.03$  inch at Key West to  $-0.42$  inch on the summit of Mt. Washington, which latter is the largest for the month. Wilmington, N. C., reports the next highest on this coast,  $-0.10$  inch, and from this station northeastward the departures along the immediate coast diminish to  $-0.06$  at Eastport. Over the interior the departures diminish from  $-0.10$  inch at New Orleans to  $-0.01$  inch at Cairo, and thence increase from  $+0.01$  inch at St. Louis to  $+0.06$  inch at St. Vincent and  $+0.07$  inch at Marquette. At western stations the following departures are given: Dodge City,  $+0.05$  inch; Bismarck,  $-0.02$ ; Pike's Peak,  $+0.05$ ; Denver,  $-0.04$ ; Cheyenne,  $-0.03$ ; Salt Lake City,  $-0.06$ . On the Pacific coast: San Diego,  $-0.05$ ; San Francisco,  $+0.02$ ; Portland, Or.,  $-0.09$ .

*Barometric Ranges.*—The range of pressure for the month has varied in the extremes from 0.18 inch at Campo, Cal., to 1.01 inch at Eastport. In general the range varied from 0.4 to 0.6 inch. Ranges of 0.7 and above were reported from the following stations: Olympia and New Shoreham, 0.7; Marquette, 0.72; Boston, Duluth and Portland, Or., 0.73; Mt. Washington, 0.74; Portland, Me., 0.76. Ranges of 0.3 inch and below were reported as follows: El Paso, 0.19; Silver City and Tucson, 0.2; Los Angeles, 0.21; San Diego, Prescott, Ariz., and Ft. Davis, Tex., 0.22; Camp Thomas, 0.24; Key West, 0.26; Stockton, 0.27; Florence, Ariz., La Mesilla, N. M., and Indianola, 0.28; Eagle Pass, 0.29; Santa Fe, 0.3. On the Atlantic and Pacific coasts the range increases with the latitude, but with a more decided contrast along the former, where the extreme difference between the highest and lowest ranges is 0.75, while along the latter it is 0.55 inch. Along the southern boundary of the country the range increases from California and Florida inward to the maximum at Brownsville, Tex., while over the northern boundary it diminishes from Washington Territory and Maine inward to the minimum in Montana.

*Areas of High Barometer.*—Six such areas have been sufficiently important during the month of June, 1881, to merit description.

No. I.—This area appeared on the morning of the 1st over the Northern Slope and the eastern portion of the Middle Plateau region, where the pressure was from 0.06 to 0.1 inch above the normal. 2nd, moved slowly eastward, covering the region from western Texas northward to British America; barometer, 0.09 to 0.2 inch above the normal. 3rd, covered nearly the whole of Texas, and spread eastward over the Upper Mississippi valley and western portion of the Upper Lakes; Leavenworth, +0.19, St. Paul, +0.16, and Duluth, +0.13 inch above the normal. On this and the preceding day the lowest temperatures of the month in Texas were recorded at most stations. During the 4th and 5th, passed southeastward over the Tennessee and Ohio valley to the South Atlantic coast. On these dates the lowest temperatures of the month in the Upper Mississippi and Ohio valleys, Tennessee, the Eastern Gulf and South Atlantic states were reported from most stations.

No. II.—Appeared on the afternoon of the 5th over the Lake Superior region; Marquette barometer, 0.12 inch above the normal. By the afternoon of the 6th this area had spread southeastward to the Middle Atlantic coast and eastward to Maine; barometer, 0.03 to 0.2 inch above the normal. 7th, pressure above the normal along the entire Atlantic coast from Key West to Sydney, Cape Breton Island. On this date occurred in New England the lowest temperatures of the month. 8th, disappeared over the ocean.

No. III.—As area No. II, left the Atlantic coast the pressure again rose decidedly over the Lake Superior region, and by the morning of the 9th the area of high covered the Missouri valley, and extended thence northeastward over the Upper Lakes and Canada to the Gulf of St. Lawrence; barometer from 0.03 to 0.18 inch above the normal. During the 9th the area spread southward to Tennessee and covered the whole of New England and the Canadian Maritime Provinces, where, in the latter district, the barometer was from 0.15 to 0.34 inch above the normal. 10th, pressure rose rapidly over New England and the Maritime Provinces, where the barometer was from 0.25 to 0.45 inch above the normal. 11th, pressure rapidly diminishing; area covered the country from the Ohio valley and Tennessee eastward to the Atlantic. 12th, remained about stationary, pressure slowly rising along the immediate coast and in the Maritime Provinces. 13th, disappeared entirely during the night, except at Sydney, Cape Breton Island, which remained above the normal until the afternoon of the 14th.

No. IV.—On the morning of the 13th the pressure was slightly above the normal from Arizona and New Mexico northward to British America, and by midnight this area had extended eastward to the Mississippi, and covered every western district except the Middle Plateau and California, being from 0.01 to 0.11 inch above the normal. 14th, spread eastward to about the 80th meridian, highest pressure in the Missouri valley; barometer, slowly falling over the Rocky Mountain and Plateau regions. 15th, covered the entire country (except Florida) from Texas north-eastward to Maine; barometer, from 0.02 to 0.3 inch above the normal; highest over the Lake region. 16th, barometer above the normal over the entire country except Florida, the Maritime Provinces and the Upper Mississippi and Lower Missouri valleys; highest pressure over the Lower Lakes. 17th, one portion of area disappeared off the South Atlantic coast and the remainder over the Mississippi valley.

No. V.—Passed southeastward from the Saskatchewan valley on the 19th; Ft. Buford barometer at midnight, 0.27 inch above the normal. 20th, covered the region north of Iowa and Illinois and every district westward to the Pacific except the Middle Plateau; highest pressure in Dakota and Minnesota, where the barometer was from 0.13 to 0.3 inch above the normal. 21st, moved southeastward the line of no change, passing northeastward from Indian Territory to the eastern end of Lake Ontario; highest pressure still in the Northwest. 22nd, pressure above the normal over the entire northern half of the country, except New England; highest pressure over the Upper Lakes. 23rd, pressure above the normal over the entire country north of the 35th parallel, except the Pacific coast; highest pressure over the Lake region. 24th, pressure everywhere above the normal east of the 107th meridian, except along the Gulf coast; highest over the Lower Lakes.

25th, centre of highest pressure about stationary; area closing up from the south, the line of no change running eastward through Tennessee. 26th, pressure above the normal from the Gulf northeastward to the St. Lawrence valley; highest barometer over New England and eastward. 27th, by midnight, area confined to the Canadian Maritime Provinces; barometer, 0.1 to 0.19 inch above the normal. 28th, disappeared off the Nova Scotia coast during the afternoon.

No. VI.—On the morning of the 28th the influence of a high pressure area was observed descending over Montana and Dakota from the Saskatchewan valley and moving southeastward; by afternoon Ft. Buford barometer 0.09 inch above the normal. 29th, a. m., barometer at Bismarck 0.2 inch above the normal, the high area during the day extending southeastward into Iowa and Kansas. 30th, a. m., barometer at Duluth 0.18 inch above the normal; area extended southwestward into Colorado and northeastward over the Upper Lakes. By midnight the pressure was from 0.02 to 0.29 inch above the normal from Texas northeastward to the province of Ontario and northward to the Lake Superior region. Further description of this area will be found in the July, 1881, REVIEW.

*Areas of Low Barometer.*—Six such areas have been charted for the month of June, 1881. No unusual display of energy was noted in the progress of any of them.

No. I.—On the morning of the 1st the barometer was above the normal at all stations along the Eastern Rocky Mountain slope and in the Missouri valley, accompanied by light rains in the latter district. By midnight the pressure had fallen decidedly over Minnesota, Iowa and Wisconsin, and the area appeared central in the southern portion of the former State. Everywhere over the country, to the south and east, the pressure was below the normal from 0.09 to 0.32 inch, and light to heavy rains, with occasional thunderstorms, prevailed from Texas, northeastward, to New England. 2d, storm passed southeastward into northern Indiana and Illinois, where it was central at the midnight report; Chicago 0.34 inch below the normal; Springfield, Illinois, and Indianapolis 0.35 inch below. The area of rain covered the country from the Mississippi, eastward to the Maritime Provinces, and the pressure over such territory was decidedly below the normal. 3d, passed southeastward to northern Virginia, where it was central at midnight, accompanied by rains, occasionally heavy, and thunderstorms throughout the Middle Atlantic states, Tennessee and the Ohio valley; pressure from 0.03 to 0.39 inch below the normal from the Gulf northeastward to the Canadian Maritime Provinces. Central morning of the 4th in western Virginia it passed off the North Carolina coast during the afternoon. Rain continued along the Atlantic coast from North Carolina northeastward to Nova Scotia, followed at the a. m. report of the 5th by northwest winds and clearing weather. Cautionary signals were ordered up along the Atlantic coast, in advance of this area, from Cape Hatteras to Sandy Hook at midnight of the 2d; from New York to Boston morning of the 3d, and at Portland and Eastport at midnight of the 3rd. All signals were justified by the following maximum velocities: Cape Hatteras, S. 42 miles; Kittyhawk, NE. 34; Delaware Breakwater, NE. 40; Cape May, NE. 30; Atlantic City, NE. 34; Barnegat, E. 36; Sandy Hook, E. 40; New York, NE. 31; New Shoreham, NE. 47; Wood's Holl, NE. 25; Boston, NE. 29; Portland, NE. 30; Eastport, N. 29. A signal hoisted at Macon morning of the 4th, and lowered morning of the 5th, was justified by W. 28 miles.

No. II.—Pressure remained from 0.06 to 0.4 inch below the normal over the Middle Slope, with occasional heavy rains and thunderstorms from morning of the 5th to the morning of the 8th, when the depression took decided form, and was central in western Illinois, with the area of rain extending eastward to the Middle Atlantic coast. By midnight was central in Ohio; Columbus barometer 0.26 inch below the normal. Very heavy rains and floods accompanied the progress of this area through the Ohio valley, causing great destruction of property. Central morning of the 9th in western Virginia, and during the afternoon passed off the coast near Norfolk. During the 8th and 9th, as the storm passed over the southwestern portion of Pennsylvania, very heavy rains and destructive floods occurred, causing a loss of property valued at over one million of dollars. Storm centre remained over the ocean, near the coast, until the afternoon of the 10th, when it disappeared to the eastward, followed along the coast by northeast to northwest winds, rising pressure, and cloudy, or partly cloudy weather, with occasional light rains. Cautionary signals were ordered up morning of the 9th from Chincoteague to Sandy Hook; afternoon, from Cape Hatteras to Delaware Breakwater; at midnight, from New York to Portland, and on the afternoon of the 10th at Eastport. All signals were justified except at Cape Hatteras, Kittyhawk, Cape Henry, New London, Newport and Eastport by the following maximum velocities: Delaware Breakwater, NE. 40 miles; Cape May, NE. 30; Atlantic City, NE. 37; Barnegat, NE. 44; Sandy Hook, SE. 44; New York, N. 33; New Haven, NE. 31; New Shoreham, NE. 48; Wood's Holl, E. 32; Boston, NE. 37, and Portland, NE. 26.

No. III.—From Texas northward to Nebraska the pressure had remained below the normal from the incipient stages of area No. II to the morning of the 10th, when the depression extended northward to Manitoba, with the barometer from 0.06 to 0.16 inch below the normal. The pressure continued to fall steadily, and on the afternoon of the 11th the area was central in western Nebraska; Omaha barometer 0.37 inch below the normal. By midnight central in southern Minnesota; St. Paul barometer 0.43 inch below the normal. Very heavy rains, and severe wind and



hail storms accompanied the progress of the area thus far, but on the 12th, as the centre passed slowly northward, and a trough of low pressure extended southwestward to Texas, the most violent wind and hail storms of the month occurred. Very destructive tornadoes formed in eastern Kansas, western Missouri and southern Iowa. On the afternoon of the 12th this depression combined with area No. IV, then in Manitoba. On the afternoon of the 11th, cautionary signals were ordered for Milwaukee, Escanaba, Marquette and Duluth, and were justified, except at the latter station by winds of from 26 to 33 miles per hour.

No. IV.—Appeared to form over the Saskatchewan valley during the 11th and 12th, and by morning of the 13th, passing in a southeasterly course, was central over Lake Superior; Duluth and Marquette barometers 0.27 inch below the normal. The area of rain extended southward to the Ohio valley, and heavy rains, with southerly winds, were reported from the northern portion of Ohio. The rains were comparatively light, with westerly winds over the Upper Lakes. During the day centre passed eastward over Ontario, and on the morning of the 14th was central near Rockliffe; barometer 0.46 inch below the normal. Clear or fair weather with westerly winds, prevailed at all Lake stations, except Kingston, where light rain was falling, wind south. During the day centre passed northeastward down the St. Lawrence, and by midnight was central near Father Point; barometer 0.44 inch below the normal. Morning of the 15th central over the Gulf of St. Lawrence; Chatham barometer 0.35 inch below the normal. During the afternoon the area passed beyond the limits of our charts.

No. V.—Appeared during the afternoon of the 15th over the Northern Rocky Mountain slope, and by midnight was central near Bismarck; barometer 0.26 inch below the normal. Occasionally heavy rains and numerous thunderstorms, with westerly winds, prevailed over the entire Northwest. Morning of the 16th central in Minnesota; St. Paul barometer 0.22 inch below the normal. During this day passed southeastward to southern Michigan, where by midnight it was central near Grand Haven; barometer 0.18 inch below the normal. The area of rain covered the entire Lake region and Canada; occasionally heavy rains fell over lower Michigan, and the severest thunderstorms for years prevailed throughout Ohio. Morning of the 17th central near Erie; through the night very heavy rains fell in western Pennsylvania and in Ohio. During the day centre passed northeastward over southern New York, and by midnight passed off the coast between Boston and Portland. During the passage of this storm over the Upper Lakes cautionary signals were ordered on the morning of the 16th at Milwaukee and Grand Haven, justified by W. 28 and S. 30 miles; at midnight, at Alpena and Port Huron, not justified; at Escanaba, Marquette and Duluth, at midnight of the 15th, all justified except at Duluth; along the Lower Lakes, at midnight of the 16th, from Detroit to Buffalo, and justified, except at Buffalo and Erie by NW. 30 miles at Sandusky. Along the Atlantic coast signals were ordered up at midnight of the 16th from Chincoteague to Sandy Hook, and at Kittyhawk and Cape Henry morning of the 17th; justified except at Kittyhawk and Sandy Hook by the following maximum velocities: Chincoteague, SW. 28; Delaware Breakwater, SW. 35.

No. VI.—Appeared to form during the 27th over the region south of Hudson's Bay; pressure below the normal over the entire Lake region and Ontario. Morning of the 28th central over Lake Superior; Marquette barometer 0.36 inch below the normal. During the day passed southeastward over the Province of Quebec, and by midnight was central in southwestern Maine; Portland barometer 0.51 inch below the normal. Light rains and thunderstorms prevailed over the Lake region and New England. Central morning of the 29th off the southwestern coast of Nova Scotia; Eastport barometer 0.65 inch below the normal, and Yarmouth 0.6 inch below. During the day skirted the eastern coast of Nova Scotia, and by midnight was central over Cape Breton Island; barometer at Sydney 0.8 inch below the normal. Light rains prevailed over the Maritime Provinces, with occasional thunderstorms and northeast to northwest winds. Cautionary signals were ordered along the Atlantic coast at noon of the 27th from Chincoteague to Sandy Hook, and in the afternoon from Cape Hatteras to Cape Henry. Justified at all stations, except Sandy Hook, by the following maximum velocities: Cape Hatteras, SW. 32; Kittyhawk, SE. 29; Chincoteague, SE. 26; Delaware Breakwater, SE. 32.

## INTERNATIONAL METEOROLOGY.

International charts, Nos. V and VI, accompany the present REVIEW. Of the former, two are published, one for the month of July and the other for the month of August, 1877. This completes the series of chart No. V for the year 1877, which were first commenced in October of that year, and finally, as indicated in an explanation given in the leading paragraph under *International Meteorology* in the January, 1881, REVIEW, it was determined to commence with January and complete the entire year. Chart No. VI is for July, 1879, and continues the series of this chart begun in October, 1877.

Chart No. V, for the month of July, 1877, shows the mean pressure, temperature, wind force and the prevailing direction of the wind at 7.35 a. m. Washington, or 0.43 p. m. Greenwich, mean time, over the Northern and at certain isolated stations in the Southern Hemisphere. The area of lowest



pressure, as indicated by the isobar of 29.70, lies off the coast of Norway, and skirts the north and west coasts of Scotland. This isobar in the previous month of June left the Norway coast at Tromsø. Over Siberia the position of the area of low remains about the same as in June, except that the centre is more decided. The pressure along the Asiatic coast is low, being from 0.03 to 0.05 inch below the mean of June. The area of 29.80, so long present over the Canadian Maritime Provinces, has finally passed to the northward, and probably covers the larger portion of British America north of parallel 50° and the southern half of Greenland. The pressure over British India has been uniformly low throughout the month, being somewhat below the mean of June in the northern Provinces, and above in the southern. The lowest pressures of the month were reported from the following stations: Roorkee and Lahore, 29.43 (747.4); Yeniseisk, 29.56 (750.7); Thorshavn, 29.64 (752.8); Peking and Stornaway, 29.65 (753.0); North Unst, 29.66 (753.3); Ninghai, 29.67 (753.5); Brono, Christiania, Sandwich Manse and Stykkisholm, 29.71 (754.5); York Factory, 29.74 (755.3); Godthaab, 29.78 (756.3). The areas of highest pressure cover in North America, the West Indies and the southeastern portion of the United States; in Europe, the southwestern portion, including Algeria, and thence eastward over the ocean to the 30th meridian; over which latter region the highest mean pressures of the month obtain. The highest pressures were reported from the following stations: Angra and Ponta Delgado, 30.35 (770.8); Melbourne, 30.30 (769.5); Valona and Mauritius, 30.24 (768.0); Funchal, 30.17 (766.2); Cape Town, 30.15 (765.7); Laghouat and Hobart Town, 30.13 (765.2); Geriville, 30.12 (765.0); Sfax and Mexico, 30.11 (764.7). The extreme monthly range of mean pressure is 0.92 inch, the largest since February, which was 0.94. The lowest temperatures given in Fahrenheit's scale were reported from the following stations: Godthaab, 44°; Melbourne, 48°; Stykkisholm and Hobart Town, 50°; Ft. St. Michaels, 51°; Thorshavn, North Unst, and Tromsø, 54°; York Factory, 55°; Stornaway and Sandwich Manse, 56°; Nikolaievsk on the Amoor, 57°. The highest temperatures were reported from the following stations: Biskra, 104°; Lahore, 100°; Tunis, 99°; Laghouat, 98°; Agra, 96°; Geriville and Tabessa, 95°. The prevailing direction of the wind over the United States was *southwesterly* along the Atlantic coast and over the Lower Lake region; *variable* over the interior; *southerly*, shifting to *west* and *northwest* over the Upper Lakes and Upper Mississippi valley, and along the Pacific coast, *northwesterly*. Over the Eastern Hemisphere, *southwesterly* along the European coast, *westerly* in the interior; *southerly* over Russia and along the shores of the Baltic; *northerly* along the southern shore of the Mediterranean; elsewhere *variable*.

Compared with the preceeding month there has been a very general fall in pressure, extending entirely over Asia, and for the most part of Europe, the variation ranging from -0.02 to -0.15 inch. There has been a slight rise over the Mediterranean and in Spain. In the United States there has been a marked fall along the Pacific coast ranging from -0.04 to -0.07 inch, elsewhere a rise; over British America a decided fall, York Factory -0.20 inch; over the West Indies about stationary. At isolated stations the following changes occur: Angra, +0.18 inch; Ponta Delgado, +0.14; Hobart Town, +0.06; Free Town, +0.05; Godthaab and Mauritius, +0.04; Ft. St. Michaels, -0.06; Melbourne and Cape Town, -0.04; Stykkisholm, -0.03; Mexico, -0.02; Ft. Napier, no change. With respect to the temperature there has been the usual rise common to the summer months; the isotherm of 50° has disappeared from northern Europe, Asia and from British America, but reappeared over the North Atlantic, and if traced would pass through Stykkisholm and around the southern point of Greenland. York Factory reports a change of +17° and Ft. St. Michaels only +4°.

Compared with July, 1878, the pressure is much higher over southern Europe, the isobar of 30.10 occupying nearly the same position as did that of 30.00. Over northern Europe and in Asia the reverse prevails. Along the Asiatic coast it is about stationary. In British India there is a rise over the southern Provinces, while the reverse prevails to the northward. Over the United States there is a slight fall east of the 100th meridian, along the Pacific coast a rise, while over British America there is a slight fall. At isolated stations the following changes are noted: Hobart Town, +0.36 inch; Melbourne, +0.30; Ft. Napier, +0.16; Cape Town, +0.15; Mauritius, +0.12; Godthaab, +0.08; Mexico, +0.03; Free Town, +0.01; Paramaribo, no change; York Factory and Stykkisholm, -0.05. With respect to the temperature there is a slight and irregular fall over southern Europe and northern Africa, but over northwestern France and the British Isles there is a change of from -2° to -5°. Over central Europe and Russia a large rise varying from +5° to +14°. Over Siberia a fall from -4° to -8°. Along the Asiatic coast a rise of from +1° to +4°, except at Nikolaievsk on the Amoor, where there is no change. Over British India it is generally higher. In the United States there is a slight fall along the Gulf coast, over the Lower Lake region and in the Middle Atlantic states; elsewhere about stationary. Over British America, between the 50th and 60th parallels, a considerable fall. At isolated stations the following changes occur: Mexico, -11°; Cape Town, -6°; York Factory, -4°; Hobart Town, -3°; Stykkisholm, -3°; Paramaribo, -1°; Ft. Napier, -1°; Melbourne, -0°; Godthaab, no change; Mauritius, +0°; Free Town, +2°.

Chart No. V, for the month of August, 1877, shows the mean pressure, temperature, wind force and the prevailing direction of the wind at 7.35 a. m., Washington, or 0.43 p. m., Greenwich, mean time, over the Northern, and at certain isolated stations in the Southern Hemisphere.

The area of lowest pressure, as indicated by the isobar of 29.80, covers the British Isles north of the 53d parallel, the southern half of Norway, Finland, northern Russia and Siberia. This area over North America, apparently very much smaller in extent, lies just to the northward of York Factory, Hudson's Bay. Over British India the pressure was uniformly low, but lowest over the Punjab. The lowest pressures of the month were reported from the following stations: Lahore, 29.43 (747.4); Vladivostock, 29.71 (754.5); Archangel, 29.73 (755.1); Kuopio and Yeniseisk, 29.76 (755.8); Vestervig and Peking, 29.78 (756.3). The areas of highest pressure cover southern Europe, Algeria and the southeastern portion of the United States. The highest pressures of the month, including isolated stations, were reported as follows: Mauritius, 30.24 (768.0); Melbourne, 30.20 (767.0); Mexico, 30.17 (766.2); Cape Town, 30.15 (765.7); Funchal, Valona and Laghouat, 30.10 (764.4); Biskra and Sfax, 30.08 (763.9). The extreme monthly range of mean pressure is 0.81 inch or 0.11 below that of July. At isolated stations the temperatures given in Fahrenheit's scale were reported as follows: lowest, Hobart Town, 46°; York Factory, 47°; Godthaab, 48°; Melbourne, Tromsø, Thorshavn and Stykkisholm, 50°; highest, Lahore, 103°; Biskra, 101°; Agra, 98°; Laghouat, 95°; Deesa and Lucknow, 94°. The prevailing direction of the wind was, over the United States *southwest* to *northwest* along the Atlantic coast, *variable* over the interior and *southwesterly* along the Pacific coast. Over Algeria the winds were *northerly*, over Spain, France and Great Britain, *southwest* to *northwest*; over Scandinavia, *northeast* to *northwest*; elsewhere *variable*. Compared with the preceding month there has been a slight fall in pressure over Algeria, the influence extending with more emphasis over Europe south of the 55th parallel and west of the 20th meridian, where a variation of from -0.02 to -0.15 inch obtained, the greatest deviation being found over Ireland, England and eastward to Denmark. Over Scotland, Scandinavia and eastward to the 40th meridian the pressure has risen, the variation ranging from +0.04 to +0.18 inch, the greatest change occurring along the coast of Norway and to the north of Scotland. Over eastern Asia there is a slight fall followed to the south and east by a rise at nearly all stations. Over British India there has been a general rise of from +0.02 to +0.07 inch. Over the United States little or no change has taken place except a slight rise in the Northwest, which increases to the northward and extends beyond Hudson's Bay. Along the Pacific coast there is a rise of 0.02 to 0.05 inch. At isolated stations the following changes occur: Angra, -0.32 inch; Ponta Delgado, -0.29; Hobart Town, -0.26; Melbourne, -0.10; Ft. Napier, -0.08; Funchal, -0.07; Free Town, -0.01; Cape Town and Mauritius, no change; Paramaribo, +0.01; Mexico, +0.06; York Factory, +0.07; Peking, +0.13; Yeniseisk, +0.20; Barnaul and Godthaab, +0.24; Stykkisholm, +0.27. With respect to the temperature, there is a general rise over Europe of from 2° to 10° from Algeria northward to the 50th parallel, while to the northward of that boundary a very decided fall of from 4° to 15° prevails, with the greatest change over northern Russia and Scandinavia. Over British India there is a slight but general rise; along the Asiatic coast a fall of from 2° to 8°, except at Nikolaievsk on the Amoor, where there is no change. Over the United States the fall has been general, but most marked north of the 40th parallel, where the change varies from 3° to 9°. This fall continues to the northward, spreading over Hudson's Bay Territory, where, at York Factory, a change of -8° is reported. Compared with August, 1878, the pressure over Europe is generally higher, the change ranging from +0.03 to +0.12 inch, the greatest deviation occurring along the Mediterranean and in Algeria. Over Asia the rise is more decided, ranging from +0.05 to +0.25 inch, but this marked deviation rapidly diminishes as you approach the Asiatic coast, where, at some stations, there is a slight fall. In British India a fall at southern stations, followed by a rise over the northern Provinces. Over the United States the rise in pressure is very marked east of the 100th meridian and particularly over the southeastern portion; this change continues northward, and reaches beyond the 50th parallel. Along the Pacific coast but little change is noted. At isolated stations the following changes occur: Godthaab, +0.20 inch; Melbourne and Hobart Town, +0.18; Mauritius and Stykkisholm, +0.11; Ft. Napier, Free Town and Paramaribo, no change; York Factory, -0.06; Cape Town, -0.10. The temperature is generally lower over Europe north of parallel 50° and south of parallel 40° and in Algeria. Between these parallels there appears a very irregular belt of country over which a rise of from 3° to 10° occurs. Over northern Asia there is a fall of from 1° to 9°; in British India a general rise of from 2° to 15°, except at the most southern stations, where a fall of about 5° is reported. Over the United States there is a general and decided fall east of the 100th meridian, and in the Pacific coast states; elsewhere but little change. Isolated stations report the following changes: Hobart Town, -8°; York Factory, -5°.4; Stykkisholm, -2°; Free Town, -0°.9; Mauritius, -0°.8; Melbourne, no change; Paramaribo, +0°.7; Godthaab, +4°; Ft. Napier, +5°; Cape Town, +6°.

*Chart No. VI.*—Upon this chart are located eighteen of the principal storm areas of the Northern Hemisphere during the month of July, 1879. Of these, five originated within the United States and west of the 100th meridian; two of which passed over the ocean to the mainland of Europe, the remainder disappearing off the Atlantic coast. Six originated over British America between the 50th and 60th parallels; two of which passed over the ocean to the mainland of Europe. Two first appeared over the ocean to the west of the British Isles, passing thence eastward to the Continent. Two commenced their formation over southern Russia, and passed thence east and northeast into central Siberia. Two formed over the central portion of the Chinese empire, and

one over the northeastern part. Concerning the storms of North America, the following is a concise description of the paths or translation of the various low areas: No. 1 first appeared on the South Pacific coast during the 1st, and moved thence east-northeast, reaching northern Colorado by the 2nd. From this locality its course changed to the north-northeast, while it moved to the Lake region during the 3rd. On this day exceedingly violent storms were experienced in Dakota and the states of Iowa, Minnesota and Wisconsin, destroying a large amount of property and causing the loss of many human lives. Over the Upper Lake region the winds were not unusually high, although the pressure was abnormally low. On the morning of the 4th the centre was in the Lower St. Lawrence valley, where the pressure fell very rapidly and the winds increased to gales. During this day the centre moved eastward to the Gulf of St. Lawrence, and thence northeastward over Newfoundland to about  $56^{\circ}$  N.,  $50^{\circ}$  W., which locality it reached by the 5th. The barometer at Godthaab, which had been quite low for several days, fell rapidly on the 4th, but reached its lowest point (29.39) on the morning of the following day, while the storm centre lay to the south. On the 5th, in  $54^{\circ}$ ,  $30'$  N.,  $24^{\circ}$ ,  $40'$  W., barometer 29.77, south-southwest gale and heavy rain. From this position the storm pursued an easterly path, reaching the north of Scotland on the 8th. On the 6th the barometer at Godthaab rose to 29.62, and the rain (which had been reported since the 4th) ceased. 6th, in  $54^{\circ}$ ,  $35'$  N.,  $27^{\circ}$ ,  $58'$  W., steamer *Johnson* experienced terrific gale from WNW., lasting 24 hours; in  $53^{\circ}$ ,  $46'$  N.,  $22^{\circ}$ ,  $46'$  W., heavy westerly gale, high seas; in  $56^{\circ}$  N.,  $19^{\circ}$ ,  $35'$  W., southeast gale, barometer 29.33; in  $51^{\circ}$ ,  $08'$  N.,  $23^{\circ}$ ,  $08'$  W., strong westerly gale, threatening, heavy west sea; at Stykkisholm the barometer had fallen 0.27 inch since the preceding morning, wind remaining east but increasing to a heavy gale; at nearly all stations over the British Isles the barometer rose quite decidedly as the storm approached from the west. On the 7th, in  $50^{\circ}$ ,  $44'$  N.,  $27^{\circ}$ ,  $16'$  W., steamer *Baltimore* experienced heavy west and west-northwest gales, with high seas; in  $53^{\circ}$ ,  $06'$  N.,  $25^{\circ}$ ,  $12'$  W., heavy westerly gales, terrific squalls, very heavy west sea; in  $48^{\circ}$ ,  $46'$  N.,  $30^{\circ}$ ,  $09'$  W., steamer *Erin* experienced strong westerly gales and high west sea; in  $50^{\circ}$ ,  $55'$  N.,  $13^{\circ}$ ,  $28'$  W., steamship *Abyssinia* experienced strong west and west-northwest gales, very heavy west sea; in  $57^{\circ}$ ,  $45'$  N.,  $14^{\circ}$ ,  $15'$  W., barometer 29.03, strong southwest gale, with rain; at Stykkisholm the wind had changed to north, fresh, barometer 29.50—a fall of 0.17 inch in past 24 hours; along the western coast of the British Isles the winds were southwest, strong, with occasional light rains, while the barometer at most stations had fallen quite decidedly; over the islands to the north of Scotland the winds shifted to southeast and northeast, with marked barometric falls; Thorshavn, barometer 29.32, wind NE.; Nairn, 29.36, W.; Aberdeen, 29.39, WNW.; Sandwick Manse, 29.35, W.; Glasgow, 29.46, WSW.; Ardrossan, 29.48, SW. 8th, in  $49^{\circ}$ ,  $55'$  N.,  $33^{\circ}$ ,  $50'$  W., northwest to southwest heavy gale, high seas; in  $51^{\circ}$ ,  $38'$  N.,  $31^{\circ}$ ,  $27'$  W., decreasing west-southwest gale, high seas; in  $51^{\circ}$ ,  $44'$  N.,  $18^{\circ}$ ,  $46'$  W., heavy westerly gale, high confused sea; in  $49^{\circ}$ ,  $22'$  N.,  $18^{\circ}$ ,  $22'$  W., WSW., violent storm, very high sea; in  $50^{\circ}$ ,  $25'$  N.,  $17^{\circ}$ ,  $51'$  W., strong WSW. and W. gales, heavy beam sea; in  $58^{\circ}$ ,  $45'$  N.,  $11^{\circ}$ ,  $30'$  W., barometer 29.21, wind NE., strong; at Stykkisholm the barometer had risen 0.26 inch, wind shifting to east. The circulation of the winds, as well as the relative pressure of adjoining stations, showed the storm centre on this date to be over the north of Scotland, lowest barometer at Ardrossan 28.98, wind SSW. At other stations the following low pressures were reported: Aberdeen, 29.06, S.; Nairn, 29.01, calm; Silloth Rectory, 29.10, SW.; Sandwick Manse, 29.11, E.; Bolton, 29.20; Stonyhurst, 29.21, SSW., squally; Holyhead, 29.21, SSW., raining; Bradford, 29.22, W; at nearly every station the barometer was below 29.50, the highest (29.94) being reported from Donaghadee. Along the southern coast of Ireland the winds shifted to west, and over southern England to south and southwest, increasing to gales; over the islands to the north of Scotland the winds were from southeast to northeast; at Thorshavn, barometer 29.35, indicating a slight rise since the day before. 9th, storm centre passed eastward over the North Sea, winds over the British Isles shifted to north and west, with rapidly rising pressures and clearing weather, the change in barometer ranging from +0.15 to +0.42 inch, the lowest barometer (29.37) occurring at Aberdeen, Bradford and Silloth Rectory. The centre of lowest pressure on this date appeared to be near the southern coast of Norway; Bergen, 29.28, NW.; Haparanda, 29.28, NE.; Tromsø, 29.33, NE.; Bronø, 29.35, N.; Christiania, 29.35, SW.; Umeå, 29.34, W.; Hernösand, 29.33, SW. 10th, depression slowly filling up, centre near Christiania, barometer 29.36, SSW.; Bergen, 29.37, WNW.; Fancø, 29.38, NE.; Vestervig, 29.39, NNW.; at other stations in Scandinavia the barometer remained about stationary or rose slightly. Over the British Isles and France northwesterly winds very generally prevailed. The area of rain extended southward over Denmark into central Germany, where the barometer ranged from 29.39 to 29.93. During the 10th the depression moved eastward in an irregular path, and on the morning of the 11th the circulation of the winds and the relative pressure of adjoining stations showed the centre to be in the vicinity of St. Petersburg, where the lowest reading (29.11) occurred; Dorpat, 29.12, SW. rain; stations in Norway showed a change in pressure of from +0.04 to +0.19 inch, while over Sweden the barometer remained about stationary, with a slight tendency to fall; the greatest variation (−0.05 inch) occurred at Umeå. 12th, depression moved northeastward to the White Sea; barometer at Archangel 29.38, SW. rain. The area of cloud and rain became more general, but the centre began to fill up quite rapidly, although the depression did not wholly disappear, as on the 13th an area of low, enclosed by the isobar of 29.80,



appeared in the vicinity of Kasan, barometer 29.75, wind SE; Archangel, 29.84, W.; Moscow, 29.80, W.; Krotkovo, 29.77, S.; Ekaterinburg, 29.95, S. 14th, centre of depression more decided and situated between Kasan and Ekaterinburg; at former barometer 29.54, WSW.; at latter 29.85, SE.; Krotkovo, 29.58, W. 15th, about stationary; Ekaterinburg, 29.64, E.; Kasan, 29.59, SW.; Krotkovo, 29.64, NW. 16th, depression moved very slowly eastward and apparently enlarged; Ekaterinburg, 29.37, E.; Kasan, 29.48, WSW.; Krotkovo, 29.57, NNW. 17th, moved east-northeast to the Valley of the Obi; Ekaterinburg, 29.50, S.; Barnaul, 29.52, SSE.; Yeniseisk, 29.75, S. 18th, moved eastward between Barnaul and Yeniseisk; barometer at latter, 29.71, NE.; at former, 29.55, SE. 19th, disappeared to the southeastward over China; Yeniseisk, 29.73, N.; Barnaul, 29.63, SSW. No. II, a continuation of low area No. XXII, traced on the *June* chart published in the *May* (1881) REVIEW, appeared on the 1st in Manitoba. Ft. Garry, barometer 29.39, wind NW.; Pembina, 29.51, WNW.; York Factory, 29.54, SSE. 2nd, depression slowly filling up, centre moved eastward to near the 90th meridian; York Factory, 29.66, E.; Ft. Garry, 29.84; Pembina, 29.80, W.; winds over the Upper Lake region shifted from southeast to southwest and west, with falling pressure: over the Canadian provinces the pressure fell more rapidly, with winds shifting to south-southwest and southeast. 3rd, centre probably over the southern portion of James' Bay; the isobar of 29.60, which previously covered a small portion of the country just south of Hudson's Bay disappeared, being replaced by that of 29.80, which embraced a very large extent of territory, including the Maritime Provinces, the country north of Ontario and from Hudson's Bay southwestward to Texas. 4th, combined with low area No. I, then in the Lower St. Lawrence valley. No. V first appeared on the 3rd in the Sacramento valley, and moved thence northeastward over the territories of Idaho, Montana and Dakota, reaching Manitoba on the 7th. During the 4th, 5th and 6th unusually heavy rains and terrific hail and thunderstorms visited this section of country, causing much loss to property; abnormal barometric falls were reported from nearly all stations. 7th, isobar of 29.60 extended in a narrow trough southwestward from Hudson's Bay to Texas; lowest barometers reported as follows: Dodge City, 29.37, SSW.; North Platte, 29.29, E.; Omaha, 29.58, SSW.; Breckenridge, 29.58, SSW.; Pembina, 29.45, W.; Fort Garry, 29.48, W. 8th, central over the province of Ontario; lowest barometers at Parry Sound and Rockliffe; the pressure west of the 90th meridian rose rapidly, except at York Factory, where a fall of 0.11 inch was reported; the area of rain extended southward to the Ohio valley and southeastward to the Atlantic ocean. 9th, central over the Gulf of St. Lawrence; Father Point, 29.54, S.; Cape Rozier, 29.52, calm; Chatham, 29.52, S.; area of rain confined to the Maritime Provinces. 10th, centre transferred to the ocean southeast of Nova Scotia, the isobar of 29.60 still covering nearly the whole of the Maritime Provinces; in 40° N., 56° W., 29.64, SSW.; in 44°, 38' N., 45°, 58' W., steamship *Erin* reported strong southerly gale, high sea. 11th, centre probably southeast of Newfoundland; barometer rose slowly over the Maritime Provinces, with clearing weather; in 46°, 08' N., 36°, 56' W., west-southwest to southeast gales, heavy rains and high westerly sea; in 41°, 35' N., 61°, 15' W., southwest strong, barometer 29.70; in 40°, 20' N., 53°, 40' W., west fresh, barometer 29.77. 12th, depression passed slowly eastward; in 44°, 10' N., 43° W., southerly gale, fog and heavy rain; in 47°, 10' N., 41° W., SW. brisk, overcast and rain. 13th, depression about stationary and imperfectly defined; in 43°, 14' N., 48°, 52' W., southerly gale, fog and heavy rain; in 49°, 20' N., 41°, 10' W., northeast, overcast and rain; in 42°, 30' N., 47°, 35' W., SSW. 29.80. 14th, depression passed northeastward, but still very poorly defined; in 46°, 03' N., 43°, 09' W., NW. violent gale, overcast and rain; in 46°, 45' N., 40°, 35' W., WNW. strong gale, high confused sea; in 48°, 03' N., 43°, 10' W., hurricane from the north, heavy sea, overcast and rain; in 47°, 03' N., 42°, 07' W., hurricane from the north, overcast and heavy rain; in 46°, 09' N., 36°, 08' W., violent southwest gale. 15th, depression moved eastward to near 50° N., 25° W.; in 50°, 20' N., 26°, 15' W., 29.58, northwest brisk; in 48°, 35' N., 32°, 15' W., 29.70, northwest brisk; in 46°, 48' N., 39°, 08' W., strong WNW. gale, high confused sea; in 4°, 31' N., 25°, 56' W., increasing storm, thick rain, high sea; in 48°, 04' N., 27°, 43' W., southwest to northwest strong gale, threatening high sea; in 48°, 04' N., 32°, 30' W., southwest to west-northwest fresh to strong gale, very heavy head sea; in 48°, 02' N., 26°, 06' W., violent westerly gale, heavy rain; in 41°, 02' N., 29°, 09' W., WSW. fresh, overcast and rain. 16th, depression moved northeastward to the Irish coast; in 51°, 01' N., 8°, 04' W., violent southeast gale, high sea and heavy rain; in 50° N., 6° W., south, strong gale, heavy rain; the area of rain covered the southern portion of the British Isles and northwestern France, reaching thence westward over the ocean; Valencia, 29.56, E.; Roche's Point, 29.69, SE.; there were no marked barometric falls reported from the English and French stations. 17th, depression passed southeastward over the English channel into northern France; the winds over the British Isles shifted from southeast and southwest to northeast and northwest, and along the western coast of France from south to west; lowest barometer at Paris, (Montsouris Observatory,) 29.54; the pressure was generally below 29.90 over the whole of western Europe, with no marked depression in any quarter; on this and the following day the depression gradually filled up over central Europe. No. VI.—This storm first appeared over the southern portion of the Northern Plateau on the 7th, and proceeded in an irregular easterly course across the United States, reaching the Atlantic coast on the 12th. Very heavy rains accompanied the course of the storm on the 10th in Minnesota and Wisconsin, and on

the 11th very violent and destructive local storms visited portions of Michigan, Ohio, Canada, Pennsylvania and Maryland. Very low pressures were reported along the Middle and South Atlantic coasts during the 11th and 12th, ranging from 0.36 to 0.48 inch below the normal, but no very high winds occurred, (highest 46 NW. at Cape Henry). After passing off the Middle Atlantic coast on the 12th, the storm pursued a peculiar course; turning to the southwest, it skirted the coast of the South Atlantic states, where the highest temperatures ever known in that section were experienced. On the 13th, moved again to the east, near the 30th parallel, and disappeared over the ocean. No. VII.—During the 10th, falling barometer, with rain, prevailed along the North Pacific coast, extending by morning of the 11th, over the Middle and Northern Plateau regions, and northward over British Columbia. On this day and the following, the pressure was abnormally low over these regions, and violent wind storms, with heavy rains, occurred in several localities. During the 12th, centre moved northeastward to Manitoba, Ft. Garry, 29.67, S. 13th, passed eastward north of Lake Superior, and thence southeastward over the Province of Ontario. 14th, central in the Lower St. Lawrence valley, lowest pressure at Montreal. 15th, passed eastward over the Canadian Maritime Provinces, reaching the ocean on the 16th, where it was central south of Newfoundland; in  $42^{\circ} 40' N. 58^{\circ} 35' W.$ , calm, heavy rain; Sydney, C. B., 29.61, calm, heavy rain; on this day the isobar of 29.80 covered the ocean eastward to the 35th meridian and westward over Canada to Hudson's Bay. 17th, this area combined with low area No. X, then central over Nova Scotia. No. X.—This area first appeared on the 14th over the region between Manitoba and Hudson's Bay, and was probably a secondary development of low area No. VII during its passage eastward on the 13th near parallel  $50^{\circ} N.$  14th, York Factory, 29.58, E., Ft. Garry, 29.71, W. 15th, depression passed slowly southeastward: York Factory, 29.57, NE., Ft. Garry, 30.00, WNW. 16th, central in the Lower St. Lawrence valley. 17th, depression covered the Canadian Maritime Provinces, lowest pressures over New Brunswick and Nova Scotia; St. Andrews, 29.45, calm; St. John's, N. B., 29.46, E., Charlottetown, P. E. I., 29.48, E.; at Heart's Content, Newfoundland, 29.71, NE., strong; in  $46^{\circ} 15' N. 50^{\circ} W.$ , NE., threatening; in  $41^{\circ} 45' N. 33^{\circ} 35' W.$ , SW., strong, heavy rain. 18th, centre passed off the Nova Scotia coast and thence northeastward over the ocean to near the 50th parallel; in  $46^{\circ} 40' N. 50^{\circ} W.$ , 29.55, SW., brisk; in  $43^{\circ} 35' N. 50^{\circ} W.$ , 29.61, SW., strong gale; in  $44^{\circ} 08' N. 47^{\circ} W.$ , south, heavy rain; in  $45^{\circ} 04' N. 46^{\circ} 08' W.$ , south, strong gale, heavy rain; in  $41^{\circ} N. 55^{\circ} 03' W.$ , SW., violent gale, heavy rain and lightning. 19th, depression passed rapidly eastward over the ocean to near the 25th meridian, where it combined with an area of low pressure slowly forming in that vicinity. The pressure over this portion of the ocean had not yet recovered from the recent passage southeastward of low area No. V, the barometer remaining below 29.80 since the 16th. In fact, on the 18th, the isobar of 29.80 appeared to cover the ocean from Newfoundland to near the Irish coast, although the reports to date were too meagre to make the position of the line positive. On the 19th, the winds along the western coast of the British Isles were from the south and southwest, and rain fell at most stations in England and Scotland. 20th, depression passed eastward, covering the British Isles, where rain or threatening weather prevailed throughout the day; lowest barometers were reported as follows: Bidston, Bolton and Stonyhurst, 29.18; Nottingham and Holyhead, 29.23; Oscott and Silloth Rectory, 29.24; Sheffield, 29.25; Leicester, 29.26. The pressure at all stations except those on the southwest coast of Ireland were below 29.60. 21st, centre passed eastward over the southern portion of the North Sea; the winds over the British Isles shifted to north and northwest, but rain or threatening weather still continued. At Ipswich, surrounding country flooded to the greatest depth ever recollected; loss of property very great. At Helesworth the rain came down in sheets, flooding everything. At Framlington, greatest flood in past fifty years. At Berwick on Tweed, incessant and heavy rain for four days; very heavy westerly gales continued on the west coasts. The pressures along the southeastern coast of England and along the coasts of Holland, Belgium and Denmark were quite low, the variation in the past 24 hours ranging from  $-0.08$  to  $-0.43$  inch. Great Yarmouth, 29.24, NW.; Cambridge, 29.36, WNW.; Helder, 29.17, SSW.; Groningen, 29.22, S.; Utrecht, 29.26, SW. The winds over Europe circulated with marked regularity about the area of low, which apparently controlled the movements of the atmosphere over a large extent of territory. 22nd, depression remained about stationary, with very little change in the direction of the winds or the extent of the area of rain. 23rd, moved slowly northeastward over northern Prussia to the Baltic; Wisby, 29.51, E., rain; Upsala and Stockholm, 29.60, NNE., rain; Christiania, 29.65, NNE., rain. Over Denmark and Prussia the winds were westerly, and in western Russia from the southeast. 24th, central over southern Sweden; Wisby, 29.44, SSW., rain; Upsala, 29.48, ENE.; Stockholm, 29.47, E., rain; Copenhagen, 29.57, WNW., rain; Christiania, 29.54, NNE. 25th, centre passed northeastward to the Gulf of Finland, followed over Denmark, Prussia, and southern Sweden by high west to northwest winds and rising pressure; St. Petersburg, 29.26, ESE., rain; Dorpat, 29.39, SW., rain. 26th, depression passed slowly eastward, lowest barometer still at St. Petersburg, 29.43, NW.; Moscow, 29.48, SSW.; Archangel, 29.57, E. 27th, moved eastward between the 50th and 60th meridians; Moscow, 29.47, E.; St. Petersburg, 29.55, NE.; Archangel, 29.63, NE.; Kasan, 29.52, SW.; Krotkovo, 29.58, SW.; Ekaterinburg, 29.46, calm. 28th, depression slowly filling up, isobar of 29.60 replaced that of 29.40. 29th, barometer falling at all stations between the 50th and 90th meri-

dians and north of the 40th parallel; area of 29.60 greatly enlarged; centre of depression not easily located. 30th, centre probably in the valley of the Obi, lowest barometer at Barnaul, 29.42, ENE.; Yeniseisk, 29.69, E. 31st, depression passed to the northeastward north of the 60th parallel; Barnaul, 29.42, SE.; Yeniseisk, 29.54, SE. No. XII, first appeared over the region west of Hudson's Bay on the 19th; York Factory reported a change of  $-0.30$  inch in barometer during past 24 hours, wind shifting from west to south-southwest. 20th, centre passed eastward along the 60th parallel; York Factory, 29.53, a fall of 0.14 inch, wind S. 21st, depression moved slowly northeastward; York Factory, 29.73, or  $+0.20$  inch, wind SW. 22nd, disappeared to the eastward over Baffins Bay and Greenland in a high pressure area there prevailing. No. XIII.—This area appeared on the 21st in Wyoming Territory, and moved thence rapidly in an irregular easterly course, passing the Lake region on the 23rd and disappearing off the coast of Newfoundland on the 25th. This storm displayed very little energy throughout its entire course. The greatest variations of pressure were reported from stations along the valley of the St. Lawrence, and heaviest precipitation from various points in New England. No. XV, first appeared in Manitoba on the 25th, Ft. Garry, 29.61, SSW.; Pembina, 29.57, W.; York Factory, 29.71, SE. 26th, central over Lake Superior, lowest barometer at Marquette and Escanaba; thus far the storm was accompanied by light local rains and considerable variations of pressure. During this day the depression passed southeastward over Lakes Michigan and Huron, and thence eastward over the southern portion of Ontario, leaving the New England coast on the morning of the 27th. Along the Atlantic coast, as far south as North Carolina, brisk to high winds were reported, and heavy rain falls occurred at New England stations. 28th, central off the eastern coast of Newfoundland, Heart's Content, 29.57, S., heavy rain; over the Canadian Maritime Provinces and southward, as indicated by several ocean reports, the winds were from northwest to southwest, accompanied by rising pressure; in  $42^{\circ} 07' N. 58^{\circ} 09' W.$ , NW. strong, rain; in  $45^{\circ} 07' N. 44^{\circ} 08' W.$ , NE. light, rain; in  $42^{\circ} 09' N. 60^{\circ} 02' W.$ , WNW. gale, rain; in  $43^{\circ} N. 54^{\circ} 06' W.$ , WSW. hurricane, rain; in  $41^{\circ} 09' N. 54^{\circ} 03' W.$ , west violent gale, rain. 29th, the isobar of 29.80 apparently covered the ocean north of the 50th parallel, from Newfoundland to the British Isles, the centre of depression being probably situated a little to the southeast of Greenland; Godthaab, 29.90, WSW. fair; Stykkisholm, 29.57, NNE. light rain; in  $50^{\circ} 45' N. 22^{\circ} 35' W.$ , 29.99, WNW. fair; in  $49^{\circ} 04' N. 21^{\circ} 02' W.$ , 29.92, NW. rain; in  $48^{\circ} 06' N. 11^{\circ} 03' W.$ , 30.04, S. fair; in  $47^{\circ} 09' N. 12^{\circ} 03' W.$ , 29.91, S. cloudy, rainy weather; although the central portion of the storm was about two days distant, the winds over the British Islands were sensibly affected by the presence of this extremely elongated area of depression, the prevailing direction being from the south. 30th, centre passed slowly northeastward, and probably reached a position a little to the west of Iceland; Godthaab, 29.78, SW. threatening; Stykkisholm, 29.51, SE. light rain; the pressure to the southeast and west had risen very rapidly, forming areas of 30.20 over Hudson's Bay and to the east of Newfoundland. The former higher area passed rapidly to the eastward during the 30th, preceded by a movement to the southeastward of the depression, which was central on the morning of the 31st over Ireland, lowest barometers, 29.73 at Valencia and Holyhead; over England and Scotland the winds were from south to east, over Ireland northeast and north, and over northern France from southeast to southwest; rain or threatening weather prevailed over the British Isles during the day. No. XVI.—Before low area No. XV had left the Atlantic coast, and while the isobar of 29.80 still covered the country north of the 45th parallel from Manitoba southeastward to the New England coast, the pressure on the 27th began again to fall to the north of Lake Superior, the changes being quite small, ranging from  $-0.03$  to  $-0.06$  inch, but the precipitation was very heavy. 28th, central north of Lake Huron, accompanied by northwest to southwest winds, and slowly rising pressure over the southern and western portions of the Upper Lakes. During the day the depression passed eastward over the provinces of Ontario and Quebec, and thence northeastward to the Gulf of St. Lawrence, which it reached by the morning of the 29th, and thereafter disappeared in an area of high pressure to the eastward of Newfoundland. The passage of this storm was marked by no exhibition of decided energy. No. XVIII.—This area was probably central on the morning of the 30th in the Saskatchewan valley; southerly winds and slowly falling pressure prevailed along the northern boundary of the United States, between the 90th and 110th meridians; during the day the depression passed slowly southeastward into the Lower Missouri valley, where it was central on the morning of the 31st. Its further course will appear on chart No. VI, for the month of August, 1879. Concerning European storms the following descriptions are given: No. III, appeared on the 1st over the central portion of the British Isles. Donaghadee, 28.98, SSW.; Ardrossan, 29.03, SE.; Sillioth Rectory, 29.10, W.; Galway, 29.13, WNW.; Holyhead, 29.14, SSW.; Bolton, 29.15, SW.; Bidstan, 29.16, SW.; threatening weather or rain prevailed over the Islands during the day; winds mostly from southwest to southeast. 2nd, central on the northwestern coast of Scotland; Nairn, 28.90, ESE.; Aberdeen, 28.94, SW.; North Unst, 29.03, SE.; Glasgow, 29.09; Ardrossan, 29.12; threatening weather or rain still prevailed, but the winds shifted to west and southwest over England and Ireland. 3rd, centre passed to the north of Scotland; North Unst, 29.97, S.; Monach Lighthouse, 29.01, WNW.; Nairn, 29.02, W.; Aberdeen, 29.12, SSW.; rain still continued at most stations, pressure slowly falling, while the winds shifted more to the west and northwest. 4th,



centre passed east-northeast to near the coast of Norway, followed by rising pressure and west to northwest winds over the British Isles, but rainy or threatening weather still continued at many stations. 5th, depression central over the southern portion of Scandinavia, accompanied by west to southwest winds over northern Germany and Denmark, and northeast winds over the northern portion of the Peninsula; Upsala, 29.35; Stockholm, 29.36; Christiania, 29.38; Copenhagen, 29.39. 6th, depression central over the Baltic; Stockholm, 29.36, NE.; Wisby, 29.37, W. 7th, central south of the Gulf of Finland, followed by westerly winds and rising pressure along the eastern coast of the Baltic; Wilna, 29.20, NW.; St. Petersburg, 29.46, NE. rain; Dorpat, 29.42, NE. rain; Moscow, 29.30, S. 8th, passed northeastward beyond the Gulf of Finland; St. Petersburg, 29.25, WSW. rain; Wilna, 29.60, WSW. rain; Archangel, 29.40, E. rain. 9th, passed northeastward beyond the White Sea; Archangel, 29.38, S. 10th, Archangel, 29.45, SW. The lowest pressures of the month accompanied the progress of this area over the British Isles. No. VIII.—On the 12th a small area of low pressure (29.60) formed off the northwest coast of Ireland. To the south and east over the British Isles the winds were from northeast to southeast, and at most stations accompanied by rain; the barometer was not very low, but the change in the past 24 hours was large, ranging from  $-0.18$  to  $-0.40$  inch. 13th, central over England; Oxford, 29.43, ESE.; Bolton, 29.45, ENE.; Cardington, 29.46, S.; over Scotland the winds were from the east and northeast, over Ireland from the north and northeast, and over northern France from the west and southwest. 14th, central over the southern portion of the North Sea; northwest winds, increasing to gales, prevailed over Scotland and Ireland, and northwest to southwest winds over England and northern France. The pressure rose gradually over the British Isles, but threatening or rainy weather still continued. 15th, central over Denmark; Copenhagen, 29.58, NE. rain; Vestervig, 29.65, NNE. rain; Fanøe, 29.79, W. rain. 16th, depression gradually filled up over northern Germany as low area No. V covered the southern portion of the British Isles. No. XI, first appeared on the 17th over southwestern Russia; Nikolaiev, 29.57, SW. rain; Kieff, 29.33, NNW. rain; Lugan, 29.47, SW. 18th, passed northeastward, central near Moscow; barometer, 29.37, NNW.; Lugan, 29.48, WSW.; Kieff, 29.60, W.; Krotkovo, 29.48, W.; Kasan, 29.46, SE. 19th, passed eastward to near Orenburg; Kasan, 29.54, SSW.; Krotkovo, 29.64, W.; Ekaterinburg, 29.54, S. 20th, central northeast of the Sea Aral; Ekaterinburg, 29.58, W.; Tashkend, 29.55, SE. 21st, central north of Balkash Lake; Tashkend, 29.46, NW.; Barnaul, 29.35, S.; Yeniseisk, 29.51, E. 22nd, central near Barnaul, barometer, 29.32, SW.; Yeniseisk, 29.43, NE. 23rd, central near Yeniseisk, barometer, 29.40, calm; Barnaul, 29.33, calm. 24th, depression disappeared to the eastward; Yeniseisk, 29.52, NW.; Barnaul, 29.60, calm. The course of this area after leaving southern Russia, as indicated upon the chart, is quite doubtful, its progress to the southeastward being over a territory from which only the most scattering and irregular reports are received. No. IV, first appeared on the 2nd in eastern Russia; Kasan, 29.27, SE. rain; Krotkovo, 29.30, NW., threatening; Ekaterinburg, 29.41, W.; the isobar of 29.40 apparently covered the whole of northwestern Siberia; Barnaul, 29.41, S. 3rd, central near Ekaterinburg, barometer, 29.22, E.; Kasan, 29.32, NW.; Krotkovo, 29.38, NNW; depression more decided, but extent of low area somewhat circumscribed. 4th, central in the Valley of the Obi; Ekaterinburg, 29.06, SW.; Kasan, 29.45, N.; Krotkovo, 29.53, NNW. 5th, depression passed slowly eastward, gradually filling up; Ekaterinburg, 29.47, W.; Barnaul, 29.56 SE.; Yeniseisk, 29.74, SSW. 6th, central northeast of Barnaul disappearing on the following day over eastern Siberia; Barnaul, 29.59, NW.; Yeniseisk, 29.70, SE. 7th, Barnaul, 29.90, WNW.; Yeniseisk, 29.67, WNW. The storms on the Asiatic coast are described as follows. No. IX.—On the 13th the barometer at Peking (29.67) showed a change of  $-0.16$  inch in the past 24 hours, air calm, rain; at stations to the southward, along the China coast, the pressure was below 29.80, and southerly winds prevailed; Vladivostock, 29.69, SE. 14th, central near Peking, barometer, 29.33, calm; Vladivostock, 29.75, SE.; conditions to southward same, except lower pressure, viz: below 29.70. 15th, central north of the Corea Peninsula; Peking, 29.40, SW.; Vladivostock, 29.83, SSE rain and fog; at Shanghai wind still southerly, with slowly falling pressure. 16th, course north-northeast, depression filling up; Peking, 29.59, NW.; Vladivostock, 29.86, SE. light rain; rainy or threatening weather, with southerly winds and rising pressure, prevailed over the Japan Islands and to the northward, barometer at Nikolaievsk on the Amoor, 29.57, NNW. 17th, course nearly due north over the Province of Manchoovia; Nikolaievsk, 29.71, calm; Vladivostock, 29.74, SE. high, rain and fog. 18th, central west of Okhotsk Sea; Nikolaievsk, 29.46, SE. threatening; Vladivostock, 29.65, SE. heavy fog. 19th, central over the Okhotsk Sea, course eastward, Nikolaievsk, 29.53, calm; Vladivostock, 29.64, SSW. 20th, central over the Kamtchatka Peninsula, course still east; Nikolaievsk, 29.69, W. fair; Vladivostock, 29.72, WSW. fair. On this day and the following depression disappeared to the eastward over Kamtchatka Sea. The course of this storm, as traced upon the chart from the 15th to the 18th, is very uncertain, owing to isolated and irregular reports. No. XIV.—On the 23rd the barometer began falling over the Provinces north of the Yellow Sea; Vladivostock, 29.72, ESE.; Peking, 29.57, calm. 24th, central north of the Japan Sea, course eastward; Vladivostock, 29.44, SE. heavy rain; Peking, 29.63, calm. 25th, course eastward across the northern portion of the Japan Sea, thereafter disappearing over the ocean; Vladivostock, 29.73, ENE. cloudy. During the progress of

this area of but slight energy, the pressure at Japanese stations remained almost stationary, accompanied by southerly winds. No. XVII.—On the 28th the barometer began to fall at all stations along the China coast south of Peking, accompanied by southerly winds, with fair to threatening weather. 29th, central west-southwest of Peking; barometer, 29.50, calm, rain; Zi-Ka-Wei, 29.59, E. fair. 30th, central south of Peking, course southeastward, barometer 29.43, N. fair; Zi-Ka-Wei, 29.54, NE. cloudy. 31st, central over the Yellow Sea, course eastward; Peking, 29.55, calm; Zi-Ka-Wei, 29.36, WSW. threatening; at other stations further south along the China coast the winds shifted southwest and west with rising barometer. Over the Japan Islands the pressure rose slightly with southeast to southwest winds. A further consideration of this storm will probably appear in the *July REVIEW*.

*Ocean Ice*.—Steamers *Nestorian*, *Mississippi*, *Riverdale* and *Quebec*, June 16th, reported large quantities in the Straits of Belle Isle, compelling the two last named vessels to take more southern passage. Schooner *Reuben*, J. Hart, master, bound from Conception Harbor for Labrador, struck huge ice-floe, on night of June 16th, two miles ENE. of Gull Island, off Cape John. Schooner *Trust*, June 20th, reported heavy ice-floes as far south as the Gravois Islands, off the mouth of White Bay; also an impenetrable wall of ice all along the Labrador coast, turning out to the eastward in latitude 53°, N. Steamer *Iceland* reported, June 21st, heavy ice-floe along the south coast of Labrador. Whole fleet of Newfoundland fishing vessels were arrested in their course northward by a heavy body of ice extending as far south as the White Bear Islands. Yacht *Hoidfisker* reported, May 24th, that during passage from Tromsø to Spitzbergen encountered such quantities of ice that voyage could not be made; vessel compelled to return. The captain stated that the ice was setting steadily toward the Russian and Siberian coasts, and instead of new ice he considered that it was the old pack ice of the past winter. The following data is taken from the "Weekly Chart of Floating Dangers," published by F. Wyneken, New York City: April 19th, iceberg passed in 43°, 25' N., 52°, 25' W., by S. S. *Donan*. May 2nd, immense fields of ice reported off Cape Breton Island. May 10th, bark *Gananogue* collided with iceberg four miles from Bird Rocks, Magdalen Islands. April 14th, S. S. *Habsburg*, in 47°, 21' N., 48°, 54' W., encountered iceberg 80 feet high and heavy drift ice. May 27th, an immense ice-pack, with numerous icebergs of gigantic size, was reported from St. John's, Newfoundland, as passing the eastern coast of that island in a southerly direction, having probably reached latitude 46°, 30' N., on that date. May 22nd, S. S. *Razoni* collided with heavy ice-floe 40 miles SE. of Gull Island, off Cape John. May 27th, S. S. *Olympia* passed several small icebergs in 42°, 55' N., 50°, 45' W.

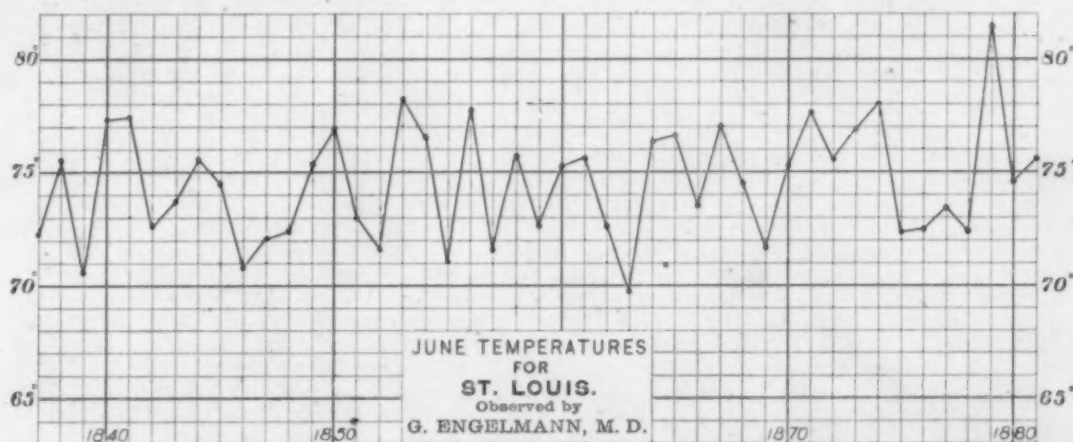
## TEMPERATURE OF THE AIR.

The mean temperature of the air for June, 1881, is shown by the isothermal lines (in red) on chart No. II. The table of mean and comparative temperatures in the right hand corner of the chart shows, in the first column, the average for the month throughout the various districts, as deduced principally from observations taken at Signal Service stations. In the two remaining columns are shown the means for the present month, and the departures of such means from the average for many years. From Lake Superior southeastward to North Carolina, and thence north-eastward to the Canadian Maritime Provinces, the temperature is from 2°.7 to 4°.4 below the normal; over the northern half of the Pacific coast, and in the Northern Plateau district, from 1°.3 to 3°.1 below the normal. Elsewhere in the various districts the temperature is from 0°.4 to 5°.1 above the normal, except in the Upper Mississippi valley and South Pacific coast region, where no change is recorded. Mt. Washington is 5°.3 below; Pike's Peak, 7°.4 above, and Salt Lake City, 3°.0 above.

*Ranges of Temperature at Signal Service Stations*.—Monthly ranges in general varied from 35° to 45° over the country east of the Rocky Mountains, and from 40° to 55° to the westward of that region. The *smallest ranges* were: Key West, 20°; Galveston, Punta Rassa and San Francisco, 21°; San Diego, 23°; Brownsville, Tex., 24°; Cedar Keys, Indianola and Port Eads, 25°; New Orleans, 26°; Cape Hatteras, New Shoreham and Eastport, 29°; Cape May, 30°. The *largest* were: Florence, Ariz., 69°; Campo, Cal., 67°; Ft. Davis, Tex., and Ft. Verde, Ariz., 62°; Missoula, Mont., 61°; Ft. Meade, Dak., and El Paso, Tex., 59°. The *daily ranges* varied in the different districts as follows: New England, from 19° at Wood's Holl and New Shoreham to 31° at Boston, Burlington and Springfield; Middle Atlantic states, 18° at Delaware Breakwater to 27° at Washington and 34° at Norfolk; South Atlantic states, 19° at Macon to 26° at Charlotte and Augusta and 27° at Kittyhawk; Eastern Gulf states, 16° at Key West to 22° at Montgomery and 24° at Mobile; Western Gulf states, 16° at Port Eads and Galveston to 22° at Vicksburg and 25° at Little Rock; Rio Grande valley, 22° at Brownsville to 34° at Eagle Pass and Rio Grande City; Ohio valley and Tennessee, 23° at Cincinnati to 28° at Indianapolis and Pittsburgh and 29° at Nashville; Lower Lake region, 21° at Toledo to 29° at Buffalo and 35° at Rochester; Upper Lake region, 21° at Grand Haven to 35° at Marquette and 43° at Milwaukee; Upper Mississippi valley, 22° at La Crosse to 28° at Des Moines and 30° at St. Paul; Missouri valley, 27° at Leavenworth to 31° at Yankton and 44° at Ft. Bennett; Extreme Northwest, 30° at Moorhead to 34° at Ft. Buford and 37° at St. Vincent; Northern Slope, 38° at Deadwood and Ft. Keogh to 43° at North Platte and 48° at Ft. Benton; Middle Slope, 25° on summit at Pike's Peak to 38° at Denver and

46° at Ft. Elliott; Southern Slope, 33° at Ft. Sill, Jacksboro and Ft. Griffin to 55° at Ft. Davis and 56° at McKavett; Northern Plateau, 35° at Lewiston to 44° at Missoula and 47° at Eagle Rock; Middle Plateau, 15° at Winnemucca to 33° at Pioche and 34° at Salt Lake City; Southern Plateau, 23° at La Mesilla to 51° at Tucson and 65° at Florence; North Pacific coast, 29° at Portland to 33° at Roseburg and Olympia; Middle Pacific coast, 18° at San Francisco to 32° at Sacramento and 35° at Red Bluff; South Pacific coast, 18° at San Diego to 40° at Visalia and 62° at Campo.

*Deviations from Mean Temperatures.*—Under this heading departures exhibited by the reports from the regular Signal Service stations are shown in the table of comparative temperatures on the right hand side of chart No. II. The following items of importance in connection with this subject are reported by voluntary observers: *Canada:* Montreal, McGill College, mean temperature 4° below that of past 6 years. *Connecticut:* Southington, mean temperature 7° below that of past 11 years; highest mean, 72° 7, occurred in 1870; lowest, 63° 5, in 1878. *Illinois:* Riley, mean temperature 2° 3 below that of past 20 years, and 0° 5 below that of the preceding month of May. *Maine:* Gardiner, mean temperature 5° 18 below that of past 45 years; in no month of June during that period has the maximum temperature been as low as that for 1881, and in only one year, 1839, (minimum 33) has the minimum reached that of 1881. *Maryland:* Fallston, mean temperature 3° 4 below that of past 10 years; highest mean, 72° 6, occurred in 1874; lowest, 68° 2, in 1878; the mean for the present month is lower than that for any June in the past 10 years. *Massachusetts:* Worcester, coldest June since 1839. *Missouri:* St. Louis, "Missouri Weather



Service" reports mean temperature 1° 3 above that of past 45 years; highest maximum, 101° 5, occurred in 1870; lowest minimum, 43°, occurred in 1838 and 1839. The above diagram shows the curve of mean temperatures for June, as furnished by Prof. T. E. Nipher, of the "Missouri Weather Service." *Nebraska:* Lincoln, "Nebraska Weather Service" reports mean temperature about 3° above the average. *New Hampshire:* Contoocookville, mean temperature nearly 6° below that of past 11 years, and 3° 3 lower than the lowest mean for any June during that period; coldest June occurred in 1878. Auburn, coldest June for many years. *New York:* North Volney, mean temperature 6° 9 below that of past 12 years; coldest June during that period occurred in 1869, mean 62° 4; warmest occurred in 1870, mean 71° 6. Palermo, mean temperature 6° 8 below that of past 28 years. Ardenia, month unusually cold. Waterburg, mean temperature 4° 5 below that of past 10 years. *Virginia:* Wytheville, mean temperature 1° below that of past 18 years; highest maximum, 92°, occurred in 1872; lowest minimum, 42°, occurred in 1880.

*High Temperatures.*—New Orleans, during the week ending June 18th highest maximum temperatures in past 43 years; 12th, 91°; 13th, 92°; 14th, 95°; 15th, 94°; 16th, 96°; 17th, 92°; 18th, 91°. Sunstrokes were numerous on the following dates; 14th to 17th, 21st, 23d, 25th to 27th. Laborers ceased work on 25th on account of extreme heat. Carthage, Mo., 10th, temperature 104° in the shade; all workmen on the Missouri Pacific Railroad compelled to quit labor. North Platte, 28th, temperature 94°; one case of sunstroke; first ever known here. Mobile, 15th, sunstrokes reported; 24th, business suspended on account of heat.

*Frosts.*—With the exception of Highlands, N. C., on the 5th, no station east of the 100th meridian and south of parallel 40° reported their occurrence. They were reported from New England and the northern portion of the Middle Atlantic states on the following dates: 2d, 5th to 7th, 15th, 16th, 21st to 24th; Lake region, 2d, 5th, 11th, 21st to 24th; Middle Rocky Mountain slope, 3d, 8th, 19th, 22d, 23d, 24th; Northern Plateau, 15th, 16th, 21st, 22d; Middle Plateau, 7th, 8th, 10th, 20th, 21st, 22d; North Pacific coast region, 8th; southern California, 4th, 11th, 18th, 19th, 20th, 21st, 29th. They were reported as injurious to vegetation from various localities as follows:



Eagle Rock, 16th; Escanaba, 6th; Port Huron, 5th, 6th, 10th, 21st, 23d; Oswego and Mt. Washington, 7th; Thornville, Mich., 6th, 21st, 22d, 24th; Friendship, N. Y., 22d; Dyberry, Pa., and Port Jervis and Watertown, N. Y., 7th; Coalville, Utah, 22d.

*Ice.*—The only station reporting its formation during the month was Mt. Washington on the following dates: 3d, 4th, 5th, 6th.

*Table of Maximum and Minimum Temperatures for June, 1881.*

State or Territory.	Signal Service.			U. S. Army Post Surgeons or Voluntary Observers.			State or Territory.	Signal Service.			U. S. Army Post Surgeons or Voluntary Observers.		
	Station.	Max.	Min.	Station.	Max.	Min.		Station.	Max.	Min.	Station.	Max.	Min.
Alabama.....	Montgomery.....	108°	61°	Green Springs.....	90°		Missouri.....				Sedalia.....		51°
Arizona.....	Florence.....	113°	44°	Maricopa.....	115°		Montana.....	Fort Keogh.....	104°				
Arkansas.....	Little Rock.....	97°	65°				Do.....	Ft. Benton.....	27°				
California.....	Visalia.....	103°		Ft. Yuma.....	110°		Nebbraska.....	Omaha.....	98°		Lincoln.....	108°	
Do.....	Campos.....	30°					Do.....	North Platte.....	49°				
Colorado.....	Denver.....	95°		Ft. Lyon.....	105°		Nevada.....	Winnemucca.....	95°	34°	Halleck.....	108°	
Do.....	Pike's Peak.....	20°					Do.....				Beale Mountain.....	26°	
Connecticut.....	New Haven.....	86°	42°				N. Hampshire.....	M. Washington.....	69°	16°	Antrim.....	97°	
Dakota.....	Ft. Mende.....	103°		Ft. Pembina.....	37°		New Jersey.....	Atlantic City.....	93°		Vineland.....	94°	
Do.....	Deadwood and Ft. Stevenson.....	42°					Do.....	Barnegat.....	48°		Freehold.....	47°	
Delaware.....	Breakwater.....	86°	55°	Dover.....	98°		New Mexico.....	La M. silla.....	108°		Ft. Wingate.....	41°	
Dist. Columbia.....	Washington.....	94°	54°				Do.....	Sante Fé.....	43°				
Florida.....	Jacksonville.....	96°		Houston.....	100°		New York.....	Rochester.....	89°		Madison B'ks.....	31°	
Do.....	Pensacola.....	64°		St. Augustine.....	81°		Do.....	Buffalo.....	42°		Weldon.....	96°	
Georgia.....	Augusta.....	102°		Forsyth.....	104°		North Carolina.....	Charlotte.....	97°	55°	Highlands.....	46°	
Do.....	Atlanta.....	59°		McPherson Bks.....	55°		Do.....	Cincinnati.....	94°				
Iowa.....	Des Moines.....	96°		Guttenburg.....	100°		Do.....	Cleveland and Toledo.....	46°		College Hill.....	106°	
Do.....	Dubuque and Davenport.....	51°		Muscatine.....	40°		Do.....	Umatilla.....	94°		Westerville.....	43°	
Idaho.....	Ft. Lapwai.....	97°					Oregon.....	Roseburg.....	41°				
Do.....	Eagle Rock.....	33°					Do.....	Pittsburg.....	90°	48°	Philadelphia, Franklin and Wellsboro.....	96°	
Illinois.....	Calro.....	95°		Swanwick.....	97°		Pennsylvania.....						
Do.....	Champaign.....	48°		Riley.....	43°		Do.....						
Indiana.....	Indianapolis.....	92°	48°	Laconia.....	90°		Rhode Island.....	Newport.....	83°	45°			
Do.....				Spiceland.....	46°		South Carolina.....	Charleston.....	97°	64°			
Indian Ty.....	Fort Supply.....	103°					Tennessee.....	Memphis.....	100°				
Do.....	Fort Sill.....	50°					Do.....	Knoxville.....	33°				
Kansas.....	Leavenworth.....	97°	57°	Ft. Wallace.....	104°	42°	Texas.....	Fo t Davis.....	111°	9°	Camp near Presidio.....	114°	
Kentucky.....	Louisville.....	95°	54°	Bowling Green.....	96°		Utah.....	Salt Lake City.....	96°	47°	Promontory.....	102°	
Louisiana.....	Shreveport.....	102°	66°				Do.....				Coalville.....	31°	
Maine.....	Portland.....	81°		Corinth.....	82°		Vermont.....	Burlington.....	84°	38°	Charlotte.....	89°	
Do.....	Eastport.....	38°		Ft. Preble.....	36°		Do.....				Woodstock.....	31°	
Maryland.....	Baltimore.....	92°	53°	Cumberland and Emmittsburg.....	50°		Virginia.....	Norfolk.....	99°		Wytheville.....	44°	
Do.....				Somerseset.....	91°		Do.....	Fort Myer.....	48°				
Massachusetts.....	Boston.....	86°		South Lee.....	33°		Washington Ty.....	Colfax.....	91°				
Do.....	Thatcher's Island.....	0°		Northport.....	92°		Do.....	Dayton.....	36°		Helvetia.....	86°	
Michigan.....	Detroit.....	89°					West Virginia.....	Morgantown.....	82°	49°	Flemington.....	42°	
Do.....	Marquette.....	31°					Do.....				Mission House.....	42°	
Minnesota.....	St. Paul.....	92°					Wisconsin.....	La Crosse.....	92°				
Do.....	St. Vincent.....	37°					Do.....	Milwaukee.....	44°				
Mississippi.....	Vicksburg.....	101°	69°	Fayette.....	68°		Wyoming.....	Cheyenne.....	97°	43°	Ft. Fetterman.....	102°	
Missouri.....	St. Louis.....	99°	53°	Brownsville.....	104°		Do.....				Ft. Bridger.....	28°	

## PRECIPITATION.

The general distribution of rain-fall for June, 1881, is shown on chart No. III, from the reports of over 500 stations. From the table in the left hand corner of the chart is obtained a monthly average for each of the various districts, determined from the records (covering a period of many years) of Signal Service stations, and also a comparison of the present month with such averages. Upon examination of the chart and a comparison with the records of June for previous years, there is found a marked deficiency over the southern half of the country east of the 100th meridian. Other deficiencies are found in the Lower Missouri valley, Minnesota and Upper Lakes. The greatest deficiency occurred in the West Gulf states and Texas, where (particularly in the latter) a period of almost unprecedented drought occurred. There was a marked deficiency in the South Atlantic states, —2.49 inches, but no reports of special suffering from drought are at hand. The excess of rain-fall was most marked from Canada southeastward to the Atlantic, over a portion of which region exceedingly heavy floods occurred. Slight excesses were reported in the Ohio, Upper Mississippi and Upper Missouri valleys, although there were many isolated cases of unusually heavy rain-falls. Along the Pacific coast the range is from normal in the South Pacific region to +1.34 inches in the North Pacific region.

In connection herewith the following notes from voluntary observers are of interest: *Canada:* Montreal, McGill College, monthly rain-fall 1.62 inches below mean of past 6 years. *Illinois:* Riley, rain-fall 1.60 above mean of past 20 years, and has only been exceeded three times during that period, viz.: in 1865, 1868 and 1869. *Iowa:* Clinton, monthly rain-fall above the mean for many years; month remarkable for unusually heavy rains. Ft. Madison, month very wet. *Maine:* Gardiner, monthly rain-fall 0.12 below mean of past 45 years; first 25 days of month very dry. *Maryland:* monthly rain-fall above the mean for past 10 years. *Missouri:*

St. Louis, "Missouri Weather Service" reports a deficiency of 2.16. *Nebraska*: Lincoln, "Nebraska Weather Service" reports average for entire State at 5.31, or 0.76 more than in June, 1880, and but a small fraction less than the average of June for the past fifteen years; rain was generally local and irregular, but it fell somewhere in the State on every day in the month except the 3d, 13th, 14th, 15th, 17th, 27th, 28th. *New Hampshire*: Contoocockville, monthly rain-fall 0.25 below mean of past 11 years. Auburn, wettest June for many years. *New Jersey*: Paterson, monthly rain-fall 7.67 above mean of 50 years. *New York*: North Volney, monthly rain-fall 0.62 below mean of past 8 years; largest rain-fall, 5.55, occurred in 1874; smallest, 2.00, occurred in 1873. Palermo, monthly rain-fall 0.90 below the mean of past 20 years; largest rain-fall, 8.80, occurred in 1865; smallest, 0.70, occurred in 1864 and 1870. *Ohio*: Cleveland, monthly rain-fall 4.38 above mean of past 27 years; largest rain-fall, 10.33, occurred in 1855; smallest, 0.34, occurred in 1861. *Texas*: Clarksville, monthly rain-fall below the mean of several years; crops suffering severely from drought. *Virginia*: Wytheville, monthly rain-fall 0.40 below the mean of past 18 years; largest rain-fall, 9.00, occurred in 1875; smallest, 2.00, occurred in 1869 and 1879.

*Special Heavy Ruins.*—2d, Franklin, N. C., 2.20 inches. 3d and 4th, New Shoreham, R. I., 3.93. 5th and 6th, Des Moines, 4.56. 6th, Geneseo, Ill., 2.80; Monticello, Iowa, 2.25; Champaign, Ill., 2.01; Clinton, Iowa, 2.16. 7th, College Hill, Ohio, 2.00; Elmira, Ill., 2.50; New Corydon, Ind., 2.55; Rockford, Ill., 2.05; Wooster, Ohio, 2.30; Morrison, Ill., 3.00; Muscatine, 2.04; Le Claire, 3.03. 7th and 8th, Niles, Mich., 4.90; Wellsboro, Pa., 5.06. 8th, Milton, Pa., 2.90; Vevay, Ind., 3.50; St. Augustine, Fla., 2.60. 8th and 9th, Franklin, Pa., 5.81. 9th, Owing's Mills, Md., 2.24; Fallston, Md., 3.85; Fallsington, Pa., 2.00; New Castle, Pa., 3.60; Hudson, Ohio, 3.50; Cleveland, 3.50; Lynchburg, 2.06; Pittsburg, 2.52; Sandusky, 2.22; Cleveland, 3.01; Ft. Hamilton, N. Y., 2.30; Murphy, N. C., 2.10; Graham, Tex., 2.10. 9th and 10th, Paterson, N. J., 7.10; Little Rock, Ark., 3.25; New Shoreham, R. I., 6.27. 10th, Woodstock, Md., 2.80; Flushing, N. Y., 2.50; Boston, 4.36; Newport, R. I., 2.91; Wood's Holl, 2.84; New York, 2.37; Blooming Grove, Pa., 2.10; Thatcher's Island, Mass., 3.76; White Plains, N. Y., 3.15; Chambersburg, Pa., 2.37. 11th, Fall River, Mass., 4.70; Ardenia, N. Y., 2.85; Westborough, Mass., 2.15; Moorhead, Minn., 2.15; Ames, Iowa, 2.08; Dodge Mine, N. J., 3.30; Elizabeth, N. J., 3.80; Ft. Columbus, N. Y., 2.98. 12th, Brunswick, Mo., 2.00. 13th, College Hill, Ohio, 3.00. 17th, Margaretta, Ohio, 2.28; Ruggles, Ohio, 2.50; Sandusky, 2.20. 19th, Keokuk, Iowa, 2.94; Evansville, Ind., 3.40. 19th and 20th, Des Moines, 5.14. 20th, Woodstock, Md., 3.00; Lynchburg, Va., 2.16. 21st, Key West, 2.13; Brunswick, Mo., 3.00. 22d, Smithville, Dak., 3.50. 22d and 23d, Independence, Kan., 4.52. 23d, Yates Centre, Kan., 2.03. 24th and 25th, Independence, Kan., 4.14. 27th, Sandy Springs, Md., 2.32; Washington, D. C., 2.59. 28th, Mt. Washington, 2.22. 30th, Laconia, Ind., 2.79.

*Largest Monthly Rain-falls.*—Wellsboro, Pa., 17.47 inches; Des Moines, 15.79; Antrim, N. H., 14.00; Flemington, N. J., 13.62; New Shoreham, 12.93; Paterson, N. J., 11.74; Smithville, 11.60; Independence, Kan., 11.26; Ft. Madison, Iowa, 10.50; Le Claire, Iowa, 10.42; New Corydon, Ind., 10.40; Muscatine, Iowa, 10.35; Sandusky, 10.09; Milton, Pa., 10.03; Morrison, Ill., 9.79; Franklin, Pa., 9.33; Oil City, Pa., 9.10; Brunswick, Mo., 9.09; Springfield, Mass., 9.07; College Hill, Ohio, 9.00; Confluence, Pa., 8.79; Meadville, Pa., 8.72; Keokuk, 8.70; New Castle, Pa., 8.40; Elmira, Ill., 8.36; Clinton, Iowa, 8.18; Johnsonstown, Va., 8.15; Catawissa, Pa., 8.08; Cleveland, Ohio, 8.07; Margaretta, Ohio, 7.98; Monticello, Iowa, 7.96; Davenport, 7.94; Fallston, Md., 7.86; Evansville, Ind., 7.85; Niles, Mich., 7.83; Cincinnati, 7.82; Baltimore, 7.81; Emmittsburg, Md., and Boston, 7.79; Freehold, N. J., 7.78; Macon, 7.71; Woodstock, Md., 7.60; Dubuque, 7.56; Thatcher's Island, 7.51; Keswick, Va., 7.50; Key West, 7.47; New Geneva, Pa., 7.43; Somerset, Mass., 7.38; Sandy Springs, Md., 7.33; Fall River, Mass., 7.26; Peoria, Ill., and Litchfield, Mich., 7.20; Laconia, Ind., 7.19; Wellsburg, W. Va., 7.15; Grand Junction, Iowa, 7.05; Coldwater, Mich., and Mt. Washington, 7.03; Austin, Tenn., and Louisville, 7.00; Independence, Ia., 6.95; Hamilton, N. Y., 6.82; Sandy Hook, 6.80; Ames, Ia., 6.70; Ft. McHenry, Md., 6.60; New Harmony, Ind., 6.45; Rockford, Ill., 6.44; Morriston, Dak., and Owings Mills, Md., 6.30; Wood's Holl, 6.25; New York, 6.23; Barnegat, 6.18; Geneseo, Ill., 6.00.

*Smallest Monthly Rain-falls.*—Visalia, Los Angeles, Oakland, Tracy, Stockton, Alta, Chico, Antioch, Brentwood, Tulare, Delano, Keene, Tehachapi, Indio, Lemoore, Lathrop, Boca, Byron, Modesto, Turlock, Kingsbury, Goshen, Sumner, Caliente, Mojave, Ravenna, Newhall, San Fernando, Spadra, Colton, White Water, Anaheim, Corpus Christi, and San Geronio, Cal.; Wadsworth, Hot Springs, Carlin, Elko, Halleck, Otego, Toano, Reno, Golconda, Beowawe, Palisade, Tecoma, and Terrace, Nev.; Promontory and Blue Creek, Utah; Texas Hill, Maricopa, Casa Grande, Ft. Thomas, Pantano, San Carlos, Phoenix, Florence and Tucson, Ariz.; Ft. Wingate and Shakespeare, N. M.; Davis, Eagle Pass, Laredo, Rio Grande, Santa Maria, Corsicana, Mason, Denison, Fredericksburg, Ft. Brown and Austin, Tex.; and Ft. Lewis, Col., none; Yuma, Ft. Verde, Prescott, Wickenburg and Ft. Grant, Ariz.; Castroville, Brownsville, San Antonio and Indianola, Tex.; Pagosa Springs, Col.; Fresno, Cal.; and Ft. Washakee, Wyo., trace; Brackettville and Decatur, Tex., Browns, Nev., and Hermosa, Col., 0.01 inch; Benson and Tennant, Cal.,

and El Paso, Tex., 0.02; Ft. McDermitt, Nev., and Pioche and Galveston, Tex., 0.03; Livermore and Campo, Cal., Almoda, Wash. Ty., and Jacksboro, Tex., 0.04; San Diego, 0.05; McKavett, Tex., 0.07; Merced, Cal., and Santa Fé, 0.08; Denver and Ft. Griffin, 0.09; Ft. Elliott, Tex., Holister, Solidad and Farmington, Cal., 0.10; Brighton and San Jose, Cal., 0.12; Dunnigan and Rocklin, Cal., and Humboldt, Nev., 0.15; Ft. Douglas, Utah, 0.16; Benecia Barracks, Cal., 0.18; Williams and Monterey, Cal., and Ft. Lyon, Col., 0.20; Ft. Sill, Ind. Ty., and Martinez, Cal., 0.21; San Mateo, Cal., and Ft. Garland, Col., 0.22; Menlo Park, Cal., 0.24; Clarksville, Tex., 0.25; Pleasanton, Cal., 0.26; Concho, Tex., 0.27; Salt Lake City, 0.28; Boise City, 0.29; Ft. Union, N. M., 0.30; Rio Vista, Cal., 0.32; Galt, Woodland and Ione, Cal., 0.33; Marysville, Cal., 0.35; Petaluma, Cal., 0.36; Niles, Cal., 0.37; Wells, Nev., Salinas, Cal., and Shreveport, La., 0.38; Point San Jose, Cal., 0.42; Princeton, Cal., Silver City and La Mesilla, 0.43; Ft. Bridger, Wyo. Ty., 0.48; Sacramento and Suisun, Cal., 0.50.

*Rainy Days.*—The number varied in New England from 11 to 21; Middle Atlantic states, 11 to 18; South Atlantic states, 8 to 17; East Gulf states, 4 to 12; West Gulf states, 0 to 10; Ohio valley and Tennessee, 14 to 21; Lower Lake region, 10 to 17; Upper Lake region, 12 to 20; Upper Mississippi valley, 12 to 21; Missouri valley, 14 to 17; Extreme Northwest, 8 to 15; Northern Slope, 3 to 14; Middle Slope, 2 to 9; Southern Slope, 1 to 7; Rio Grande valley, 1 to 2; Southern Plateau, 0 to 7; Middle Plateau, 1 to 5; Northern Plateau, 3 to 20; North Pacific Coast region, 12 to 20; Middle and South Pacific Coast regions, 0 to 4.

*Cloudy Days.*—The number varied in New England from 4 to 14; Middle Atlantic states, 6 to 14; South Atlantic states, 0 to 17; East Gulf states, 1 to 8; West Gulf states, 0 to 3; Ohio valley and Tennessee, 0 to 12; Lower Lake region, 8 to 12; Upper Lake region, 5 to 11; Upper Mississippi valley, 5 to 16; Missouri valley, 3 to 12; Extreme Northwest, 6 to 13; Northern Slope, 3 to 10; Middle Slope, 0 to 3; Southern Slope, 0 to 2; Rio Grande valley, 0 to 2; Southern Plateau, 0 to 7; Middle Plateau, 0 to 4; Northern Plateau, 4 to 14; North Pacific Coast region, 14 to 20; Middle and South Pacific Coast regions, 0 to 7.

*Snow.*—Carson City, Nev., 7th, fell on mountains west of station during night; Ft. Bidwell, Cal., 7th. Bangor, Me., 16th; Mt. Washington, 21st; Pike's Peak, 2d, 4th, 5th; Ft. Benton, 9th, 11th, 22d.

*Hail-storms* were of frequent occurrence in various parts of the country, the most destructive being reported as follows: Franklin, N. H., 22nd, about 4 p. m., many hail stones were more than one inch in diameter; half the houses in the town had their windows shattered, and gardens everywhere were ruined. 28th, hail stones fell more than half an inch in diameter. Two thirds of the buildings in the town had their windows shattered; crops in the surrounding country suffered severely. A violent wind accompanied the storm, which uprooted trees, demolished chimneys and wrecked several buildings. Freight cars at the depot of the Northern Central railroad were blown from the track. Wichita, Kan., 24th, most destructive ever known here. A section of country ten miles wide and twenty miles long, in the Arkansas River valley, suffered very great damage. Thousands of acres of wheat, corn and oats were cut down level with the ground; even the prairie grass was mown clean, while orchards and grape-vines were stripped of their fruit. Washington, D. C., 27th, most violent for several years; storm came up rapidly and in the most threatening manner from the northwest, and continued about 40 minutes. Hail stones about the size of small hazel nuts; hundreds of sparrows killed, considerable window glass broken, and green-houses and vegetable gardens injured. Storm was entirely confined within the city limits, and passed from NW. to SE. Patchogue, Long Island, 23rd, very destructive; hail stones of unusually large size, destroying crops and a large amount of window glass. Andover, N. H. 28th, great loss to growing crops and window glass. Mill Creek, Union county, Ill., 2nd, ground covered to a depth of from two to four inches, and drifts eight to ten inches deep were reported from several localities. Wheat, corn and fruit crops entirely destroyed over a section two miles wide by ten miles long. Grant's Pass, Oregon, 9th, hail fell to the depth of several inches, and in many places drifted three to five feet deep; great destruction of property. Lewiston, Idaho, 3rd, 3 p. m., heaviest hail-storm ever experienced in this section, some hail stones measured six to eight inches in circumference. The destruction of window glass was very great, and in a number of places fields of grain were cut down as clean as if by machinery; direction of storm southwest to northeast; duration from eight to ten minutes. Asotin, Idaho, 3rd, remarkably heavy; large number of sheep killed; chickens, goslings, curlews, doves and other small birds were killed by the hundreds; storm lasted about ten minutes. Anna, Ill., 2nd, four miles west of station, most violent storm ever known; fruit, grain and vegetable farms nearly devastated; hail a foot deep in some places on the following morning. Lamar, Mo., 9th, hail stones size of goose eggs; windows broken in all parts of the town, and farm crops badly cut up. North Platte, Neb., 9th, several miles west of station, many hail stones reported to be fourteen and a half inches in circumference; in several places telegraph wires broken and roofs of houses punctured. 24th, all glass on the north and west sides of buildings destroyed; growing crops very badly damaged. Rome, Henry County, Iowa, 12th, violent hail and wind storm; several buildings unroofed, and great destruction to window glass and crops. Monteith, Guthrie county, Iowa, 12th, hail stones tearing shutters to pieces and breaking window glass; crops beaten into the ground, and much



general

stock and poultry killed. At Adair, very heavy hail; several buildings unroofed. At Casey, crops destroyed and buildings badly damaged. At Mento, City Hall unroofed, windows broken, farm crops ruined; almost impossible to estimate the damage. Avoca, Pottawattomie county, Iowa, 12th, 5,000 panes of glass broken; buildings otherwise damaged. In surrounding country calves, hogs, chickens and ducks were killed by the enormous hail; cattle and horses were terribly bruised; hail stones size of man's fist. In Auderbon and Cass counties, 12th, hail stones of remarkable size, and blown into drifts two to three feet deep; growing crops almost obliterated. Rockingham county, Va., 25th, near North Mountain, hail fell to a depth of six inches, the stones being of uncommon size, and remaining on the ground for twenty-four hours. Deadwood, Dakota, 6th, during the afternoon hail stones, size of hen's eggs, fell for over two hours; one stone was reported to have measured twenty-one inches in circumference. Cincinnati, Ohio, 13th, hail stones from two to six inches in circumference, and some reported to have been five inches in diameter; twenty minutes after the storm stones were picked up as large as goose eggs. Green-houses and gardens damaged severely, and many thousand panes of glass broken; severest storm ever experienced. Abilene, Kansas, 9th, continued for about twenty minutes, causing great damage to window glass, trees and garden crops; in country loss to crops very heavy. Beloit, Kansas, 9th, very heavy, breaking window glass and destroying crops. Solomon City, Kansas, 9th, glass in the north windows of nearly all of the houses in the city were broken; hail stones as large as walnuts, and covering the ground to a depth of several inches. Chester, Ill., 2nd, hail stones nearly the size of goose eggs, doing great damage to gardens, trees and windows, and severely injuring persons and stock. Storm continued for fifteen minutes. Clinton, Ill., 2nd, great damage to fruit and growing crops. Storm continued for about ten minutes. Rockbridge, Ill., 2nd, hail stones one and a half inches in diameter; hundreds of acres of wheat completely torn to pieces, and not worth harvesting; fruit very badly damaged. Walnut Grove, Ill., 2nd, over 500 acres of growing wheat and young corn terribly cut up; large amount of window glass broken. White Hall, Ill., 2nd, most violent storm ever experienced; great destruction of wheat, corn, potatoes and fruit; a number of birds, chickens, and rabbits were found killed by the hail; direction of storm path northwest to southeast; length, about seven miles; width, one mile.

## RELATIVE HUMIDITY.

The percentage of mean relative humidity for the month ranges as follows: New England, from 64 to 90; Middle Atlantic states, 60 to 82; South Atlantic states, 55 to 83; East Gulf states, 60 to 80; West Gulf states, 52 to 72; Ohio valley and Tennessee, 62 to 77; Lower Lake region, 66 to 77; Upper Lake region, 69 to 76; Upper Mississippi valley, 67 to 76; Missouri valley, 66 to 68; Extreme Northwest, 65 to 74; Northern Slope, 57 to 66; Southern Slope, 29 to 57; Rio Grande valley, 52 to 73; Southern Plateau, 18 to 25; Middle Plateau, 13 to 27; Northern Plateau, 37 to 48; North Pacific coast region, 66 to 73; California, 36 to 77. *High stations* report the following percentages not corrected for altitudes: Pike's Peak, 48; Santa Fe, 20; Cheyenne, 33; Denver, 31; Mt. Washington, 78.

## WINDS.

The prevailing winds during the month of June, 1881, at Signal Service stations, are shown on chart No. II by arrows, which fly with the wind. Over the country east of the Mississippi and south of the Ohio, *southwest*. Over the the Lakes, *northerly*. Over the Middle Atlantic states and New England, *variable*. From Texas northward to Manitoba, *southeast* and *south*. Over the Plateau regions, *south* to *west*. Along the Pacific coast, *westerly*.

*Total Movements of the Air.*—The following are the *largest* total movements at Signal Service stations: Mt. Washington, 18,323 miles; Wilmington, 14,792; Portsmouth, 11,800; Hatteras, 11,420; Pike's Peak, 11,178; Ft. Sill, 10,418; San Francisco, 10,183; Kittyhawk, 9,717; North Platte, 9,450; Stockton, 9,441; Sandusky, 9,425; Chincoteague, 9,414; Delaware Breakwater, 9,344; Dodge City, 9,238; Ft. Elliott, 9,097; Macon, 8,977; Eagle Rock, 8,729; New Shoreham, 8,657; Cape Henry, 8,496; Thatcher's Island, 8,386; Barnegat, 8,260; Champaign, 8,082; Decatur, 8,067; Cape Henry, 8,029. The *smallest* are Lynchburg, 1,198; La Mesilla, 1,511; Phoenix, 1,780; Florence, 1,880; Lewiston, Idaho, 2,256; Duluth, 2,552; Roseburg, 2,687; Silver City, 2,737; Tuscon, 2,821; Memphis, 2,829; Nashville, 2,860; Washington, D. C., 2,939; Augusta, 2,947.

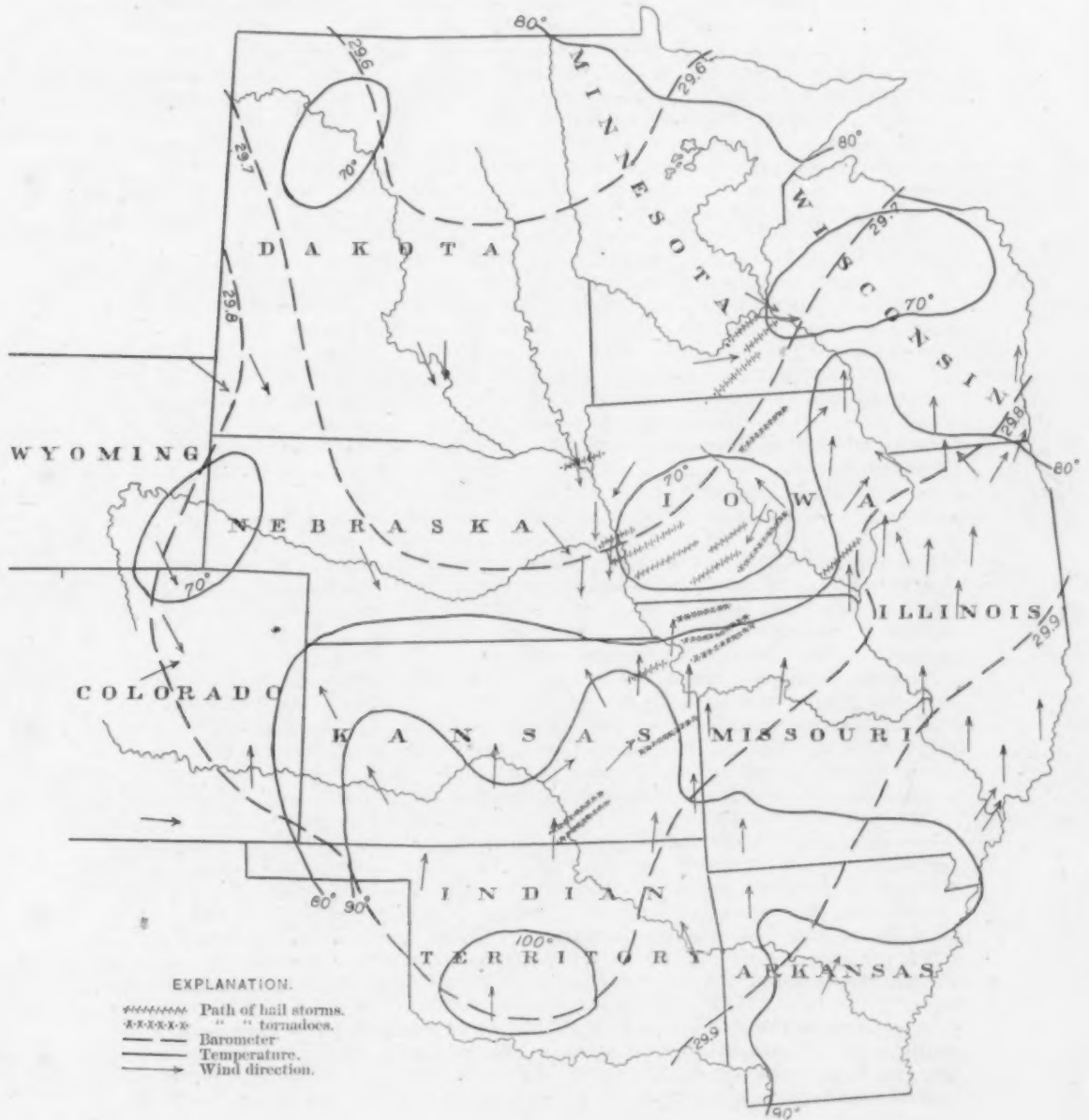
*High Winds.*—Winds of 50 miles per hour and over were reported as follows: On summit of Mt. Washington, 3d, 5th, 6th, 10th, 14th to 20th, 27th, 29th; maximum velocity, 94 miles NW. 16th. On summit of Pike's Peak, 76, SW. 15th; North Platte, 24th, 25th, 28th; maximum velocity, 60, W. 25th; Ft. Keogh, 60, SW. 5th; Portsmouth, 60, NE. 22d; Sandusky, 57, NW. 29th; Yankton, 56, W. 28th; Dodge City, 56, NW. 25th; Thatcher's Island, 56, NE. 10th; Ft. Buford, 55, NW. 10th; Cape May, 53, W. 8th; Stockton, 52, SE. 28th; Ft. Stevenson, 50, SE. 15th; Delaware Breakwater, 50, NW. 8th; Chincoteague, 50, SW. 29th; Morgantown, 50, W. 29th.

*Local Storms.*—Storms of this character have not been unusually frequent or severe during the present month, although the loss of life and property has been very great. The most destructive were confined to the region known as the Lower Missouri valley, comprising the western portions

of Missouri and Iowa and the eastern portion of Kansas and Nebraska. Several storms were reported by the newspapers and others as *tornadoes*, but upon examination they proved to be only very severe hail-storms or wind storms of considerable force, the characteristics of a tornado proper not being manifested. The most violent of that class of storms, called tornadoes, occurred on the afternoon of the 12th, and during that portion of the day the peculiar atmospheric conditions which prevailed over the Lower Missouri valley, as indicated upon Map "A" accompanying this REVIEW, are given as follows: The area of low barometer extended from the Upper Lake region southwestward to northern Texas, and thence northward to Manitoba. Along the southeastern edge of this area and northward to parallel 40° the winds were from south to southwest, with temperatures ranging from 80° to 100°. Over Iowa, Nebraska, and extending thence westward into Colorado and Wyoming, a belt of north to northwest winds prevailed, with temperatures ranging from 63° to 78°. Confined to a region of country having a width of about 500 miles a thermal difference of 37° was presented along the line of conflict between the opposing northerly and southerly winds. Bounded by the distinctive features of these atmospheric currents it is found that Kansas, Missouri, Iowa and Nebraska, but more particularly the two former, come within the region of violent wind storms and tornadoes. Andrew Co., Mo., 12th, about 5 p. m., violent tornado formed 8 miles northwest of Savannah and passed in an easterly direction several miles north of the town. Its course continued a little north of east until it reached Flag Springs, when it bore still more to the north, passing over the village of King City, De Kalb Co., after which its course could not be traced from the imperfect data at hand. During its incipient stages the path of destruction was about 160 yards wide, increasing thereafter to about one quarter of a mile. The storm cloud was funnel shaped, with the smaller end toward the earth. At times it would careen from side to side, followed by an upward and downward motion of the body of the cloud, as if drawing itself into a sheath. Along the path of the storm everything was swept clean; the destruction of growing crops could not be estimated. About 80 buildings were demolished and 12 or 15 persons killed. One man was reported to have lost 80 head of cattle, another 250 sheep, and another 6 head of horses; other farmers lost heavily in stock, the losses of this nature being unprecedented. De Kalb Co., Mo., 12th, about 5 p. m., tornado formed several miles to southwest of Winslow and moved thence northeastward passing near that town. Continuing its northeasterly course it reached the village of Berlin, Gentry Co., thereafter disappearing to the northeastward near Grand River. Several persons were killed outright and many seriously injured. The destruction of houses, barns, fences and farming implements was very great. Width of storm path about 200 yards. Nodaway Co., Mo., 12th, between 4 and 5 p. m., tornado formed in vicinity of City Bluffs, near the Nodaway River, and passed northeastward to the west of Hopkins. Several persons were killed and many buildings demolished. Indiana, Pa., 7th, very violent and destructive tornado; cloud funnel shaped, small end toward the ground. Direction of movement southwest to northeast, passing over the most thickly settled portion of Washington, Wayne and Cherryhill townships. Fifteen buildings were destroyed and a large amount of growing timber, fences, crops, &c. At some points the storm was not more than 100 yards wide, and at times would appear to lift from the ground and again descend with redoubled fury. Length of storm path over 15 miles. Loss of property estimated at \$40,000. Osage Co., Kan., 12th, about 4 p. m., tornado formed east of Olivet, near the Marias des Cygnes River, and passed northeastward over the country lying to the South of Salt Creek, and traversing portions of Olivet, Melvern and Agency townships. At Quenemo, near the junction of Salt Creek and the river above named, many buildings were demolished, the debris being scattered for miles. Along the course of the storm cattle were lifted into the air and dashed lifeless to the ground; articles of household goods were smashed into atoms, and bedding and clothing whipped into rags. In some cases people were stripped of their clothing by the force of the wind, and small objects were carried several miles. Five persons were reported killed and over 20 wounded. Over 50 buildings were totally wrecked, and together with the loss to crops, fences and orchards the damage is estimated at \$150,000. Cowley Co., Kan., 12th, about 4 p. m., tornado formed to the southwestward, near the Arkansas River, a few miles below Minnescah, and passed thence northeastward to the town of Floral, on Timber Creek, where it destroyed 28 houses, killed 3 persons and wounded 22. The whole town was nearly wiped out of existence. Where the storm cloud struck the creek the water was sucked up and carried over the adjoining fields in the path of the storm. The leaves on the trees were withered as by the heat of fire, and huge trees were pulled up by the roots or twisted off by the terrible force of the wind. The cloud was in hue a greenish black, with streaks of fire apparently darting through it. Its form was funnel shaped, with the smaller end toward the ground. Its movement was not altogether continuous and regular, but it would gyrate from side to side and then dart forward with renewed energy. After leaving Floral the storm's course was still northeastward, and great destruction to crops, fences and buildings was caused in the neighboring country. Length of storm path over 20 miles, the width varying from a few hundred feet to a quarter of a mile. In many instances the line of destruction would be very closely defined, for on one side of a road the land might be swept clean, while no injury would be done on the other side. This storm is considered the most destructive that ever visited southern Kansas. Belleplaine, Sumner Co., Kan., 12th, about 4 p. m., tornado formed several miles to the southwest, near the Minnescah River. Course of storm path north-

# MAP "A,"

Showing the Pressure, Temperature and Wind Direction, at about 3 p.m., June 12, 1881, over the territory visited by the violent tornadoes and hail storms of that date.







eastward, crossing the Arkansas River three miles south of Mulvane Junction. Cloud funnel shaped, with the small end downward, drawing everything inward and upward. During the passage of the cloud hailstones over two inches in diameter fell in large quantities, and a hot southerly wind prevailed, which made it difficult to breathe and turned the leaves of corn as black as dirt. Warren Co., Iowa, 12th, about 4 p. m., tornado formed in the northwestern part of the county, some miles southwest of Norwalk, and moving thence northeastward passed over that town, destroying 8 buildings and much other property. Still further northeastward the storm passed near the town of Rising Sun, in Polk Co., where 11 buildings were wrecked and several persons killed. Passing over North River the storm cloud was reported to have sucked up large quantities of water and partially demolished the wagon bridge. A farmer was reported to have lost every hill of corn in 30 acres, it being pulled up by the roots. At Colfax, Jasper Co., in the line of the storm, 7 buildings were destroyed. The course of the storm thereafter continued to the northeast. Hancock Co., Iowa, 12th, about 4 p. m., tornado formed over the central portion of the county and passed northeastward, its first destructive effects being felt at a Bohemian settlement 4 miles west of Garner. Here it destroyed about 15 buildings and seriously injured 9 persons. Over the country to the northeastward everything was destroyed in the path of the storm; buildings, farm machinery and crops were in terrible ruin. Many objects were carried long distances; a clock 2 miles, a lumber wagon 40 rods, a horse 50 yards, &c., &c. Morris and Lyon Cos., Kan., 9th, very violent northwest storm passed southeastward down the valley of the Neosho. At Dunlap, storm struck about 5 p. m., demolishing from 10 to 15 buildings and killing two persons. On Rock Creek, some distance below, 1 person killed and several buildings wrecked. At Council Grove, storm struck about 4:30 p. m. Several buildings unroofed, but more serious damage occurred in the surrounding country. At Americus two large churches were nearly demolished, several small houses and outbuildings blown over, and wind mills, orchards and fences suffered badly. At Plymouth orchards were ruined and outbuildings generally unroofed or blown down. At Emporia storm struck about 7 p. m., and proved to be the most violent since the very destructive storm of 1878. The western portion of the town suffered most severely, although the damage was considerable in other portions. About 25 buildings were blown down or unroofed and many other minor damages committed. The heaviest wind, accompanied by a deluge of rain, continued with some variability for about an hour and a half, although a very brisk wind prevailed all night. At Neosho Rapids still further southeastward, and near the county line, no material damage was done, the storm having apparently lost considerable of its energy before reaching this point, or shifted its course further to the south. Mitchell, Ottawa and Dickinson counties, Kansas, 9th, between 5 and 6 p. m., very violent northwest storm, accompanied by heavy rain and hail, passed southeastward down the Solomon valley. Fifteen or twenty buildings were demolished along the river, between Beloit and Solomon City, and very serious damage to crops by the hail and rain. Five persons were reported killed. Storm continued for about one hour. Blue Earth City, Faribault Co., Minn., 12th, about 4 p. m., most violent wind storm that ever visited this section. Five inches of rain fell in 1 hour, and 10 or 12 buildings were demolished, but the damage to crops was not very great. After leaving this point the storm passed northeastward, visiting the town of Luria, in the northern part of the county, where 7 buildings were wrecked and 2 persons killed. Northfield, Rice Co., Minn., 12th, about 5 p. m., most furious wind and rain storm ever experienced; estimated wind velocity, 75 miles per hour; in 13 minutes 2.00 inches of water fell. Trees were uprooted, sidewalks and fences carried away, and several buildings blown down or unroofed. Shakopee, Scott Co., Minn., 12th, about 7 p. m., furious wind and rain storm; several buildings unroofed, trees uprooted and fences carried away; damage to crops in surrounding country very great. Eureka, Nev., 3rd, 4 a. m., terrific wind storm, continuing unabated for 12 hours, when it died out suddenly. Nothing like it ever before experienced. Dust and gravel filled the air continually, and completely stopped business; fences blown down, trees uprooted and buildings unroofed. The wind came from the south without a variance; weather warm, sky perfectly clear, not a cloud visible. Deadwood, Dak., 6th, p. m., whirlwind struck Deadwood gulch, near the junction with Whitewood gulch, completely destroying 4 buildings and killing 2 persons. Hundreds of trees were uprooted, and thrown in some instances 500 feet. Telegraph poles were torn up for several miles, and everything in the path of the storm was carried away. The storm divided and disappeared before reaching the thickly settled portion of the town. Pittsburg, Pa., 29th, about noon, violent northwest storm of wind and rain passed over the hill district, including the 13th and 14th Wards. Trees uprooted, fences carried away, and several houses and outbuildings blown down. Storm lasted about 40 minutes. Delaware Co., Pa., 29th, violent northwest storm in northern part of county; several buildings unroofed, trees uprooted, and hundreds of acres of grain laid waste. Width of storm path about 1 mile; storm continued for 1 hour. Port Republic, Va., 25th, violent wind storm from the southwest; width of path about a mile and a half; length, 6 miles. Many buildings unroofed and blown over, and hundreds of acres of wheat, corn and garden crops entirely destroyed. A large amount of valuable timber was ruined. Mill Creek, Iowa, 28th, grist mill demolished, and several other buildings unroofed. Fonda, Pocahontas Co., Iowa, 25th, several buildings blown down. Merrill, Plymouth Co., Iowa, 25th, passenger train on side track overturned by the wind; several buildings unroofed. Alexandria, Ind., 12th, violent wind storm; fences and chimneys blown down, and several buildings unroofed. Queen's Peak, Montague Co., Texas, 12th, houses and fences blown down and trees uprooted; crops badly damaged.

Wakeman, Ohio, 16th, most violent storm ever experienced in this section; buildings torn to pieces or unroofed, orchards and forest trees uprooted, fences scattered and crops destroyed. Cherokee Co., Iowa, 28th, about 4 p. m., tornado from the southwest passed over the town of Cherokee, demolishing several buildings and killing three persons. From this point the storm passed northeastward over portions of Buena Vista, Clay and Palo Alto counties. The destruction was mostly confined to the country, where the loss to farmers was very great. Calhoun Co., Iowa, 30th, about 5 p. m., tornado formed southwest of the town of Manson, and moving northeastward, visited that place, where nearly every house was destroyed and several persons killed. The storm continued its course northeastward through the northwestern portion of Webster Co. and the southeastern portion of Humboldt Co., in both of which the destruction of buildings, crops, fences and farm machinery was very great. Anna, Ill., 2d, 4 miles west of station, heaviest wind storm that has visited this section for years; barns and sheds were blown to pieces, trees stripped of their foliage, and many of the larger ones twisted in two. Boonville, Mo., 7th, very violent, much damage to crops and fences, and several buildings blown down. Tuscola, Ill., 5th, 8 miles north of station, very violent wind storm, causing great damage to fruit trees, crops, buildings and fences. Nokomis, Ill., 29th, 5 p. m., most terrific for years; trees, buildings and fences blown down; farm crops suffered severely; at Shelbyville a heavy freight train was brought to a stand, and could not be moved until storm abated. North Platte, 25th, 5.40 p. m., wind backed to northwest and west and blew a hurricane, with gusts of 90 miles per hour; path of destruction commenced about 10 miles west of station, and pursued a course nearly due east for a distance of about 140 miles. Several wind mills and buildings were blown down before reaching the city, which the storm traversed in the northern part, demolishing the round house of the Union Pacific Railroad Company, killing 1 person and wounding 2 others; one portion of the building was carried to the northeast, and the other to the northwest. Heavy masses, in some instances weighing ten tons, were carried a distance of 200 feet. Storm appeared to follow the Platte river. Washington, D. C., 27th, about 8 p. m., heavy northwest storm; large number of buildings unroofed and partially blown down; shade trees uprooted and fences prostrated; loss estimated at about \$140,000. Course of storm NW. to SE.; no damage committed outside of city limits.

## VERIFICATIONS.

*Indications.*—The detailed comparison of the tri-weekly indications for June, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of verifications to be 86.75 per cent. The percentages for the four elements are: Weather, 88.2; Direction of the Wind, 80.1; Temperature, 87.6; Barometer, 81.7 per cent. By geographical districts they are: For New England, 86.3; Middle states, 87.1; South Atlantic states, 88.3; Eastern Gulf states, 89.3; Western Gulf states, 95.1; Lower Lake region, 85.8; Upper Lake region, 84.3; Tennessee and the Ohio valley, 87.7; Upper Mississippi valley, 85.0; Lower Missouri valley, 77.4; Northern Pacific coast region, 75.0; Central Pacific coast region, 90.9; Southern Pacific coast region, 100.0. There were 180 omissions to predict (60 being due to the absence of reports from the Pacific coast), out of 3,690, or 4.88 per cent. Of the 3,510 predictions that have been made, 125, or 3.56 per cent., are considered to have entirely failed; 101, or 2.88 per cent., were one-fourth verified; 389, or 11.08 per cent., were one-half verified; 277, or 7.89 per cent., were three-fourths verified; and 2,618, or 74.59 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

*Cautionary Signals.*—Eighty-one Cautionary Signals were displayed during the month, of which 63, or 77.77 per cent., were fully justified by winds of 25 miles per hour, or over at, or within a radius of 100 miles of the station. No Off-Shore Signals were displayed. The above does not include signals ordered at display stations where the velocity is only estimated; 122 winds, of 25 miles or over, were reported, for which no signals were ordered; 14 signals were ordered late.

## NAVIGATION.

*Stage of Water in Rivers.*—In the table on the right hand side of chart No. III are given the highest and lowest stages of water, as observed on the Signal Service river gauges during the month of June, 1881. In the Red, Arkansas and Savannah rivers the highest stage was reached on the 1st, and the lowest between the 23d and 30th. The highest stage in the Missouri river was reached between the 15th and 16th; in the Mississippi with considerable irregularity, but generally between the 15th and 24th; at Keokuk the water reached within 13 inches of the danger line on the 21st; at Vicksburg within 16 inches on the 1st, and New Orleans within 4 inches on the same date. In the Ohio, highest stage between the 10th and 16th, the water rising 85 inches above the danger line at Pittsburg. In the Cumberland, Tennessee and Monongahela the highest stage was reached between the 5th and 13th. The Williamette, at Portland, Or., reached its highest stage on the 16th.

*Floods.* due to unusually heavy rains, were particularly destructive throughout the western portion of Pennsylvania, and extending thence down the Ohio affected in a less degree the bordering states. *Arkansas:* Little Rock, 9th, lower portion of city flooded; sewers bursted, causing great damage. *District of Columbia:* Washington, 27th, 2.34 inches of rain fell in 38 minutes, flooding cellars and basement stores, and injuring sewers. *Indiana:* Seymour, 8th, most violent and heavy rain-storm ever experienced in this section; railroad tracks washed away and all travel closed; many houses flooded and business partially suspended. *Illinois:*



Peoria, 6th, streets flooded and all streams in vicinity above their banks; several bridges on the Bureau Valley road washed away. Parmer City, 6th, heaviest floods for years; large areas of corn and wheat lands under water, and all farm work suspended; great damage to farming interests. *Michigan*: Manistee, 16th, unusually heavy rain; cellars flooded and streets badly washed; one bridge carried away. *Ohio*: Millersburg, 16th, crops on hill lands badly washed; railroad travel greatly delayed by numerous wash-outs. Mount Vernon, 18th, railroad and highway bridges washed away; crops severely damaged. Steubenville, 11th, river 39 feet above low-water mark and stationary; lower portion of city submerged; all travel suspended, either by rail or boat; thousands of acres of wheat and corn along the bottom lands submerged. East Liverpool, 11th, highest water for many years; most of the pottery works obliged to close; western portion of city flooded, and people compelled to leave their houses. Warren, 10th, Mahoning river overflowed; lower portion of city submerged; bottom lands under water; great destruction of property. Youngstown, 10th, Mahoning river overflowed; low lands submerged, causing much destruction of property. Portland Station, 10th, river highest ever known; great loss to crops; Warrenton, 10th, portion of city submerged; all travel and business closed. Medina, 10th, highest for many years; stock had to be removed to high lands for safety; bridges carried away and roads impassable. Minerva, 10th, river highest for many years; the debris of bridges, trees, fences and buildings floating down stream; great loss of property in town and country. Wellsville, 10th, greatest flood ever known; lower portion of town completely inundated; destruction of property very great. *Pennsylvania*: New Castle, 10th, Shenango and Neshannock rivers, highest during the past 67 years; four fifths of city submerged; every rolling-mill, machine-shop, furnace and factory in the city flooded; all telegraph lines down; loss, over \$100,000. Connellsville, 10th, the Youghiogheny river highest for many years; railroad bridge swept away. Yowerville, 10th, city submerged; loss of property very great. Parker, 10th, highest water since 1873; water works 10 feet under water; glass works partially flooded; many houses abandoned; all railroad travel closed. Meadville, 10th, has rained incessantly since the 5th; French Creek overflowed; railroad tracks badly washed, and all travel ceased. Freeport, 10th, river highest since 1865; most of the town submerged; bridges all gone; houses in lower portion of town afloat; impossible to estimate the damage. Beaver Falls, 10th, Big Beaver river, highest for many years; portion of town flooded; all railroad traffic suspended. New Brighton, 10th, huge landslide along the Alum Rocks, covering the railroad track to a depth of from 10 to 60 feet; Beaver river highest for many years. Monongahela City, 10th, water highest for many years; country about badly flooded; roads in a fearful condition; very little damage in city. Emlenton, 10th, highest water since 1865. West Newton, 10th, water highest for many years; considerable damage to mill property. Pittsburgh, 10th, highest water since the great flood of 1832; over 3,000 buildings submerged. The principal loss of property falls to the lumbering interests, and it is estimated that at least 10,000,000 feet of lumber was floated off along the Allegheny; all railroad traffic has been very seriously obstructed, and the losses to the various companies reach over \$100,000. No great damage was committed along the Monongahela, as much of the perishable property was removed in anticipation of the flood. The entire loss to property in city and vicinity is estimated in round numbers at \$2,000,000. The following are the highest stages of water ever recorded at Pittsburgh, with dates of same: November 10th, 1810, 32 feet; February 10th, 1832, 35; February 1st, 1840, 26.9; April 19th, 1852, 31.9; April 12th, 1860, 29.7; September 29th, 1861, 30.9; January 20th, 1862, 28.7; April 22d, 1862, 25; March 4th, 1865, 24; March 18th, 1865, 31.4; April 1st, 1865, 21.6; May 12th, 1865, 21.6; February 15th, 1866, 22; March 13th, 1869, 22.6; March 18th, 1870, 22; April 15th, 1871, 20.6; December 14th, 1873, 25.6; January 8th, 1874, 22.4; December 28th, 1875, 21.6; September 19th, 1876, 23; January 17th, 1877, 23.7; December 11th, 1878, 24.2; March, 1879, 20; February, 1880, 21.6; February, 1881, 23.4. Industry, 11th, river 40 feet above low water mark; highest ever known; lower portion of town completely inundated; great destruction of property above and below the railroad. Kittanning, 11th, lower portion of town completely submerged; business entirely suspended; people leaving the city. Sharpsburg, 11th, water highest for many years; all trains stopped; market gardens along the river bank completely destroyed; lower portion of city submerged; bridges all gone; business suspended. Etna, 11th, lower portion of town submerged; all railroad travel closed; town entirely surrounded by water; people passing out by means of a temporary ferry. Franklin, 10th, southwestern portion of town flooded; all roads impassable; railroad travel closed; bridges and culverts washed away. Greenville, 10th, lower portion of town submerged; all trains delayed and tracks washed out. Scranton, 10th, lower portion of city flooded; highest water for many years. Aberdeen, 10th, railroad tracks submerged and washed out, all travel ceased; heavy and incessant rains for three days. Stoneboro, 10th, water highest for many years; heavy and incessant rains for four days; bridges gone and roads impassable. Rochester, 10th, lower portion of town submerged; Beaver river higher than ever before known. Bolesville, 10th, whole town flooded; all travel and business closed. Freedom, 10th, town partially flooded; people leaving for places of safety. St. Clair, 10th, portion of town flooded; great destruction of property; farmers along the river bottoms leaving for places of safety. Bridgewater, 10th, highest water ever known; immense fields of grain destroyed. Harmarville, 10th, river highest for past 16 years; Twelve Mile Island overflowed to a depth of 8 feet; great loss to garden and farm crops. Bradford, 17th, heaviest rain storm that ever visited Tuna Valley; creeks and rivers overflowed, causing great destruction of property. *West Virginia*: Wheeling, 8th, remarkably heavy rain storms; narrow mountain streams converted into raging rivers, carrying everything before them; the National Road bridges were swept away, farms inundated and

crops destroyed; houses were flooded without warning, and people driven into the streets. At Glenn's Run, 4 miles from the city, a house was carried away, drowning five persons. Fulton, 8th, damage to property very great; farms flooded for miles; crops a total loss. Leatherwood, 8th, most of town flooded; bottom lands under water; loss to crops almost incalculable; bridges everywhere carried away. Philadelphia, 8th, several buildings flooded; railroad and other bridges carried away; loss of property very great.

*Water Spouts.*—On Chesapeake Bay, off Hooper's Island, 9th, during the passage of a severe squall, a large spout suddenly descended, and, catching a small schooner near by, completely turned her over. Port Eads, La., 29th, two were observed at 1.20 p. m., over the Gulf to the southeast; they formed under a cumulo-stratus cloud in the shape of a cone; one disappeared before its completion; the other gradually elongated until it reached the water. The upper portion, or cone, was of the same color as the cloud, and the lower portion was of a light gray. It moved to the SSE., and at 1.28 p. m. broke, leaving a ragged edge, which rose to the cloud. Ft. Stevenson, Dakota, 11th, observed about two miles from post before the approach of a terrific hail-storm.

*Cloud Burst.*—Seven Star Springs, Barry Co., Mo., 11th, broke in the hills above the town, the water rushing down, carrying away houses, household goods and animals. Five persons drowned.

*High Tides.*—Coney Island, 10th, unusually high, overflowed the meadows behind the hotels.

## TEMPERATURE OF WATER.

*The temperature of water* as observed in rivers and harbors at Signal Service Stations, with average depth at which observations were taken, is given in the table on the left-hand side of chart No. III. Owing to breakage of instruments, etc., observations are wanting as follows: Cleveland, 1st to 5th and 9th; Indianola, 1st to 22d; San Francisco, 1st to 20th.

## ATMOSPHERIC ELECTRICITY.

*Thunder Storms.*—In the various districts they were reported on the following dates: New England, 4th to 7th, 13th to 15th, 19th to 21st, 23d, 26th, 28th and 29th. Middle Atlantic states, 1st to 10th, 13th, 14th, 16th to 21st and 26th to 30th. South Atlantic states, 1st to 4th, 6th, 8th to 11th, 14th, 17th to 22d, 24th to 30th. Eastern Gulf states, 1st, 2d, 4th, 6th to 12th and 14th to 30th. Western Gulf states, 1st, 2d, 4th, 6th to 10th, 13th, 14th, 16th, 17th, 19th to 27th, 29th 30th. Ohio valley and Tennessee, 1st to 9th, 13th to 21st, 23d, 25th to 30th. Lower Lake region, 1st, 2d, 6th to 8th, 12th, 13th, 15th to 17th, 20th, 25th, 27th, 28th. Upper Lake region, 1st to 3d, 5th to 8th, 11th to 13th, 16th, 18th to 20th. Extreme Northwest, 5th to 13th, 15th, 16th, 19th, 26th, 27th. Upper Mississippi valley, 1st, 2d, 4th to 8th, 10th to 21st, 23d, 24th, 26th to 30th. Missouri valley, 1st to 12th, 14th, 15th, 17th, 19th to 30th. Northern Slope, 1st to 15th, 18th to 25th, 28th. Middle Slope, 1st to 12th, 14th, 17th, 19th, 21st to 30th. Southern Slope, 1st, 2d, 5th to 12th, 25th to 27th, 29th. Rio Grande valley, 6th, 8th, 20th, 26th, 29th. Southern Plateau, 3d, 5th, 14th to 16th, 18th, 24th. Middle Plateau, 4th, 10th, 13th. Northern Plateau, 1st to 3d, 7th to 10th, 13th, 14th, 18th to 20th, 23d, 28th. North Pacific coast region, 8th. California, 2d, 3d, 5th, 6th, 14th.

The following items of interest connected with the peculiar manifestations of electricity during the progress of thunder storms were obtained from various sources: Williamsbridge, Westchester Co., N. Y., 14th, at telegraph office, where 116 wires centre, the electric current was so powerful that it drove everyone out of the rooms. The switch boards were covered with one sheet of fire; large balls of electricity leaped from the instruments and shot out from the pins and plugs at the end of the wires. The manager of the office was knocked down as he approached the switch board. In the vicinity of the town two boys were instantly killed as they took shelter from the storm under a large tree. Not a mark or bruise except a black spot on the left leg of one of them was found upon their bodies. The lightning followed down the trunk in a serpentine manner, boring a ragged hole in the ground near the roots. Wakefield, N. Y., 14th, house demolished, prostrating the inmates and killing a horse standing in the street. One of the inmates was thrown violently to the floor, and had a hole about the size of a saucer burned in her dress. Rockport, Ind., 24th, two laborers having driven a reaping machine under a tree, were struck, one of them instantly killed, while the other had his pantaloons legs ripped open and his shoes torn off, but no further injury. Arcola, N. J., 14th, ice-houses fired and destroyed; one laborer was struck and thrown 40 feet. Elizabeth, N. J., 14th, while two persons were fishing in a sail boat upon Newark Bay one of them was killed instantly, leaving the other uninjured. His clothing was stripped from him and his left boot ripped open as if it had been cut with a knife. The lightning after leaving the body tore a large hole in the bottom of the boat. Anne Arundel Co., Md., 10th, a barn containing 15 or 20 people was struck, killing four persons and severely injuring several others. Two of the victims were fearfully burned, while the others showed only a purple scar where struck. Reistertown, Md., 10th, a young man killed while working in the field, his companion standing very close to him was only knocked down, but with no resulting injury. Henrietta, Tex., 9th, two ladies instantly killed while riding along in a carriage. Peoria, Ill., 11th, a farmer while crossing the iron bridge over Kickapoo river was instantly killed; his son close beside him was not injured. Hunnewell, Kan., 12th, a farmer instantly killed

while unsaddling his horse in the barn. His clothes were completely torn from his body, his watch-chain melted, and his face and body badly mangled. The horse was killed and one end of the barn torn out. Clinton Valley, Ohio, 20th, boy instantly killed while riding horseback. His body bore no marks, but the horse on which he rode was torn to pieces. Jamaica, N. Y., 23d, a young girl while seated under a tree was struck and knocked a distance of 10 feet, but not seriously injured; three other persons near by were fatally injured. Detroit, Mich., 16th, house struck, blackening the walls and tearing off picture moldings. At the Marine Hospital a forty-foot flag-staff situated on the roof was shattered to within 20 feet of the base, where the electric current was conducted down the iron braces, making two small sharply cut holes in the corrugated iron roof. Ohio, 16th, the most destructive electric storm ever known was experienced throughout central and northern portion of the state. Dubuque, Iowa, 18th, a man while seeking shelter in a ice-house was struck, the lightning scorching one of his legs severely and tearing off his shoe and stocking. A brakeman leading two dogs within the yard of the Illinois Central Railroad Company had both of them killed while he escaped the slightest injury. At the Norwegian Plow Works the lightning made such a terrific display as to drive all of the employees out of the buildings. At the Illinois Central Freight Office, balls of fire were constantly shooting from the telephones. Wauwatosa, Milwaukee Co., Wis., 16th, during a light rain the lightning descended the chimney of a house, killing one of the occupants. The room in which the person was killed had the plastering torn from the walls; a heavy bedstead was jerked into the middle of the room, shivered into long pieces and set on fire. A stove was smashed to atoms, and crocks, pans and other wares were broken and twisted into all kinds of shapes. The other rooms of the house were not in the least affected, and six children sleeping in the main part were undisturbed.

*Atmospheric Electricity Interfering with Telegraphic Communication.*—Ft. Sill, 6th, 7th, 9th; Jacksboro', 7th, 9th; Stockton, 1st, 5th, 6th, 8th, 26th, 27th; Decatur, 9th.

*Auroras.*—There were no unusually brilliant displays during the month, and no continuous observations on a single date embracing a considerable extent of territory. The following stations reported on various dates: Portland, Me., 5th, 10.30 p. m., 6th; Burlington, Vt., 5th, 9.30 p. m.; Woodstock, Vt., 5th, 6th; Springfield, Mass., 29th, 9 p. m.; Ithaca, N. Y., 4th, early part of evening; Rochester, 4th, 9 p. m.; Detroit, 6th, 1.30 a. m.; Alpena, 9th, 8 p. m.; New Corydon, Ind., 17th, 10 p. m., small extension; Marquette, 5th, 9.15 a. m., 7th, early morning; Dubuque, 13th, 8.40 to 9.22 p. m., 20th, 8.30 to 9.11 p. m., 25th, 8.40 p. m.; St. Vincent, 30th, 12.45 a. m.; Clear Creek, Nebr., 16th, 17th, 21st, very faint.

*Zodiacal Light.*—Cleveland, 28th; Nashville, 14th to 19th, 22d to 24th, 27th, 29th; New Haven, 15th; Monticello, Ia., 3d, 17th.

## OPTICAL PHENOMENA.

*Lunar halos* have been observed in the various districts on the following dates: New England, 9th, 11th; Middle Atlantic states, 2d, 7th to 10th, 15th; South Atlantic states, 1st, 5th, 7th to 9th; East Gulf states, 3d, 6th, 8th to 10th; Texas, 1st to 8th, 10th, 24th; Ohio valley and Tennessee, 6th to 13th, 16th, 18th, 19th, 24th; Lower Lake region, 11th, 24th, 30th; Upper Lake region, 4th, 6th to 9th, 15th, 18th, 19th, 20th, 21st; Upper Mississippi valley, 4th, 9th, 10th, 11th, 14th; Missouri valley, 3d, 16th; Northern Plateau, 6th, 13th; Middle, Plateau, 10th, 11th; Southern Plateau, 5th, 9th; Middle Pacific coast region, 9th, 11th.

*Solar halos* have been observed in the various districts on the following dates: New England, 3d, 7th, 9th, 10th, 14th, 16th, 19th, 24th, 26th; Middle Atlantic states, 25th; South Atlantic states, 2d; Ohio valley and Tennessee, 1st, 10th, 12th, 13th, 15th, 16th, 18th, 19th, 21st to 30th; Lower Lake region, 6th, 25th; Upper Lake region, 6th to 9th, 11th, 15th, 20th, 29th; Upper Mississippi valley, 2d, 5th, 9th, 17th, 18th, 21st to 24th, 28th, 29th; Missouri valley, 5th; Eastern Slope, 9th, 10th, 20th, 25th; Texas, 5th; Northern Plateau, 2d, 6th, 14th, 16th, 10th, 22d, 24th, 25th; North Pacific coast region, 1st, 2d, 16th, 23d, 25th, 29th; Middle Pacific coast region, 2d, 5th, 11th to 14th, 23d, 25th.

*Polar Bands.*—Portland, Or., 16th, 18th, 29th; Rio Vista, Cal., 2d, 19th, 27th; New Corydon, Ind., 11th; Guttenburg, Ia., 5th; Fayette, Miss., 26th; Freehold, N. J., 5th, 19th.

*Mirage.*—Indianola, 23d, 24th; Cape May, 28th, appeared in the southern horizon from 3 to 6 p. m.

## MISCELLANEOUS PHENOMENA.

*Meteors.*—Umatilla, 2d. Boise City, 17th, 21st. Ft. Missoula, 24th. Ft. Apache, 20th. Bismarck, 23d. St. Vincent, 30th; very brilliant, starting from near the head of "Hercules" and fell slowly to the earth; was of a greenish color, and its brightness so great that the whole sky seemed darkened when it disappeared. Denison, 23d, 26th. Decatur, 4th. Corsicana, 16th, 19th; that of latter date was very brilliant; appeared about 70° above horizon and pursued a northwesterly course, its path being about 25° in length; it left a bright trail, lasting several seconds. Mobile, 27th. Davenport, 2d, 27th. Cairo, 24th. Milwaukee, 21st; brilliant; from southeasterly part of heavens; it left a long luminous track in its course toward the pointers in "Ursa Major." Cleveland, 24th, 29th. Detroit, 12th; several observed. Ocean City, Md., 25th. Bangor, Me., 7th, 10 p. m.; large; seemed to fall directly to the earth. Mt. Wash-



ington, 12th. Green Springs, Ala., 23d, 10.11 a. m.; an explosion was heard at different places, some of the points being as far as 50 miles apart; observers report it as being a double explosion; a gentleman living in Pickens county, 26 miles west, reported that a meteoric stone fell at his place and buried itself in the ground. Princeton, Cal., 3d, 7.30 p. m.; moved from zenith with southeast trail. St. Meinrad, Ind., 21st. Monticello, Ia., 18th. Rowe, Mass., 12th, 14th. Clear Creek, Neb., 12th, 16th, 17th, 26th. Freehold, N. J., 22d. Aiken, S. C., 29th. Stateburg, S. C., 15th, 20th, 23d, 30th.

*Forest Fires.*—Ft. Apache, 23d, fire on all sides of post; whole country lighted up at night. 25th, fires gradually going out, except in mountains. Pike's Peak, 21st, 22d, fires burning on mountain. Ft. Grant, Ariz., 2d, 3d, fire in Sulphur Springs valley and Santa Rita mountains; 12th, 14th, 23d, large fires in Aravapia mountains, 20 miles from station. Ft. Bayard, N. M., 16th, 17th, 22d, 23d to 25th. Brackettville, Tex., 23d.

*Earthquakes.*—Campo, Cal., 30th, sharp shock at 8 a. m., causing buildings to shake considerably; direction from southeast to northwest; was preceded and accompanied by a heavy rumbling noise.

*Sunsets.*—The characteristics of the sky as indicative of fair or foul weather for the succeeding twenty-four hours have been observed at all Signal Service stations. Reports from 182 stations show 5,444 observations to have been made, of which 20 were reported doubtful; of the remainder 5,424, or 84.4 per cent., were followed by the expected weather.

*Sun Spots.*—The following record of observations, made by Mr. D. P. Todd, Assistant, has been forwarded by Prof. S. Newcomb, U. S. Navy, Superintendent Nautical Almanac Office, Washington, D. C.:

DATE— June, 1881.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		REMARKS.
	Groups	Spots.	Groups	Spots.	Groups	Spots.	Groups	Spots.	
7, 5 p. m.	1	2			1	2	3	9	
11, 7 a. m.	2	20					4	40†	
12, 9 a. m.	2	5	1	3	1	2	5	45†	
15, 2 a. m.	2	10	1	5	1	3	7	50†	
16, 7 a. m.	0	0	0	0	0	0	7	40†	
15, 7 a. m.	0	0	2	10	0	0	5	25†	
19, 2 p. m.	0	0	0	0	0	0	4	15	
21, 10 a. m.	0	0	0	0	0	0	3	10	
22, 10 a. m.	0	0	0	0	0	0	2	5	
23, 8 a. m.	2	5	0	0	2	5	4	10	
24, 5 p. m.	0	7	0	0	0	0	4	17	
26, 1 p. m.	1	25†	1	2	1	15	4	40†	
29, 8 a. m.	1	25†	0	0	1	10	5	65†	Many of the spots small.
30, 9 a. m.	0	0	0	0	0	0	5	60†	Many of the spots small.

†Approximated.

Faculae were seen at the time of every observation.

Mr. William Dawson, at Spiceland, Ind., reports as follows: 3d, 2 groups, 65 spots; 9th, 5 groups, 27 spots; 10th, 5 groups, 33 spots; 11th, 4 groups, 35 spots—nearly all at east side; 16th, 7 groups, 35 spots; 21st, 3 groups, 8 spots; 25th, 5 groups, 2 large ones near east side; 30th, 4 groups, 90 spots, several very large. Mr. D. Trowbridge, at Waterburg, N. Y., reports: 2d, 4th, 2 groups, 9 spots, one large group of six spots near centre of disk; 11th, 2 groups; 13th, 2 groups, one the same as observed on 11th, and one near east margin of disk; 14th, 4 groups, 9 spots, two of the groups must have been on the disk on 13th, but were not seen; 15th, 3 groups, 5 spots, two of the groups seen on the 14th have disappeared; one new one near east side appeared by rotation; 18th, 5 groups, 6 spots, faculae near east group and east margin of disk; 19th, 5 groups, 5 spots; 23d, 1 spot, faculae in east; 24th, 4 groups, 6 spots, faculae in east, 2 new groups appeared by rotation; 25th, 4 groups, 7 spots, faculae in east and west; 26th, 3 groups, 9 spots, west group disappeared by rotation; 29th, 5 groups, 15 spots, faculae in east. Mr. H. D. Govey, at North Lewisburg, Ohio, reports: observed on every day during month, except 5th and 6th, when it was cloudy; the largest were observed on the 1st; least, 10th and 22d; most numerous, on 14th and from 25th to 30th.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

*H. B. Hazen*

Brig. & Bvt. Maj. Gen'l.,  
Chief Signal Officer, U. S. A.

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WAR DEPARTMENT  
SIGNAL SERVICE  
DIVISION OF TELEGRAMS AND REPORTS FOR THE ARMY









**WAR DEPARTMENT**  
**SIGNAL SERVICE, U.S.**  
**DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF THE**  
**ISOBARS, ISOTHERMS AND PREVAILING**

TEMPERATURE OF WATER FOR  
 1918

STATIONS.	Temperature Fahrenheit.	Average depth of water in feet.
Atlantic City.....	71	10.0
Albany.....	65	10.0
Augusta.....	68	10.0
Baltimore.....	68	10.0
Boston.....	63	10.0
Buffalo.....	68	10.0
Burlington, Vt.....	65	10.0
Cedar Key.....	87	10.0
Charleston.....	80	10.0
Chicago.....	85	10.0
Chillicothe.....	80	10.0
Cleveland.....	73	10.0
Detroit.....	68	10.0
Duluth.....	61	10.0
Del. Breakwater.....	73	10.0
Eastport.....	45	10.0
Essex.....	67	10.0
Galveston.....	89	10.0
Grand Haven.....	75	10.0
Indianapolis.....	90	10.0
Jacksonville.....	90	10.0
Key West.....	89	10.0
Marquette.....	58	10.0
Milwaukee.....	61	10.0
Mobile.....	85	10.0
New Haven.....	66	10.0
New London.....	53	10.0
Newport.....	63	10.0
New York.....	66	10.0
New Shoreham.....	64	10.0
Norfolk.....	61	10.0
Pennsauken.....	84	10.0
Portland, Maine.....	50	10.0
Portland, Or.....	60	10.0
Port Eads.....	86	10.0
Punta Raza.....	80	10.0
Sandy Hook.....	74	10.0
Sandy Hook.....	73	10.0
San Francisco.....	58	10.0
Savannah.....	80	10.0
St. Louis.....	85	10.0
Thatcher's Island.....	69	10.0
Tulsa.....	74	10.0
Wilmington.....	84	10.0
Woods Hole.....	68	10.0

Observations for only part of month—see text.

PUBLISHED BY THE  
 1873  
 DRIG. & BYT. MAJ G

AVERAGE TEMPERATURES FOR JUNE, 1881.			
DISTRICTS	Average for Jan. Signal Service Observations.		Comparison of May, 1881, with the average for several years.
	For several years.	For 1881.	
North Pacific coast region...	61° 2	59° 7	1° 5 below.
Middle Pacific coast region...	60° 9	66° 8	5° 9 below.
South Pacific coast region...	64° 4	64° 3	Normal.
North Pacific States...	60° 0	60° 0	0° 0 below.
Salt Lake City...	66° 0	71° 6	5° 6 above.
Southern Plateau district...	75° 6	76° 0	0° 4 above.
North Rocky Mt. slope...	68° 7	65° 3	3° 4 below.
Middle East. Rocky Mt. slope...	71° 4	78° 7	7° 3 above.
Southeast Rocky Mt. slope...	67° 1	70° 0	2° 9 above.
Upper Mississippi valley...	67° 5	70° 1	2° 6 above.
Missouri valley...	71° 1	70° 9	Normal.
Minnesota...	64° 1	65° 4	1° 3 above.
Upper Lake region...	63° 6	59° 5	4° 1 below.
Lower Lake region...	66° 0	61° 6	4° 4 below.
Ole valley and Pinnacles...	73° 3	74° 6	1° 3 above.
Sierra Nevada...	94° 3	86° 6	7° 3 above.
Western Gulf States...	70° 5	68° 7	1° 8 above.
Eastern Gulf States...	78° 7	81° 5	2° 8 above.
Florida Peninsula...	70° 6	83° 1	12° 5 above.
South Atlantic States...	77° 3	79° 0	1° 7 above.
North Atlantic States...	80° 0	68° 1	11° 9 below.
New England...	64° 8	60° 5	4° 3 below.
Mt. Washington, N. H.	44° 1	38° 5	5° 6 below.
Pike's Peak, Col.	52° 8	60° 3	7° 5 above.



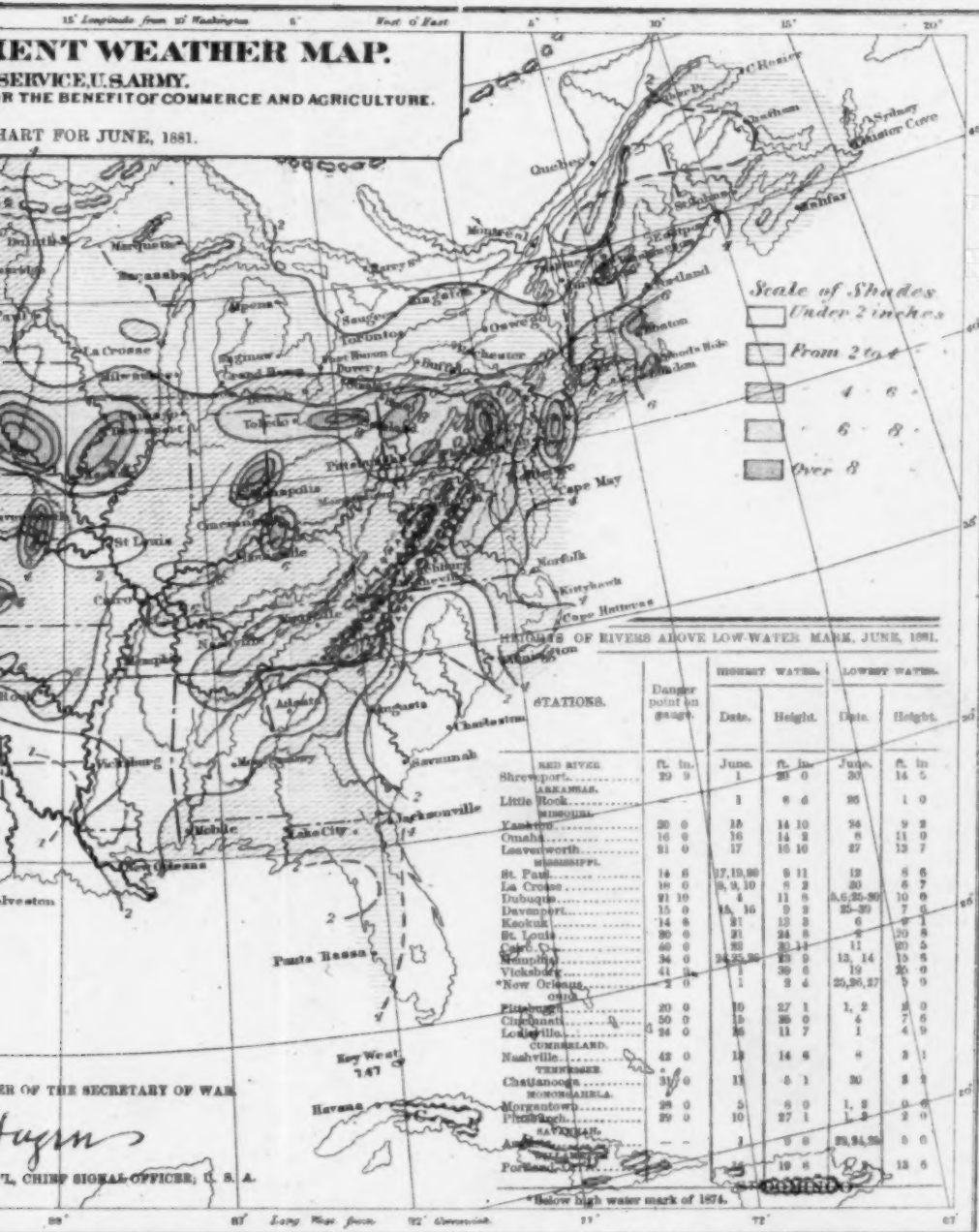
### PRECIPITATION CHART FO



5718. A BVT. MAJ. GEN'L. CHINESE

**WINTER WEATHER MAP.**  
**SERVICE, U.S. ARMY.**  
**FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.**

CHART FOR JUNE, 1881.



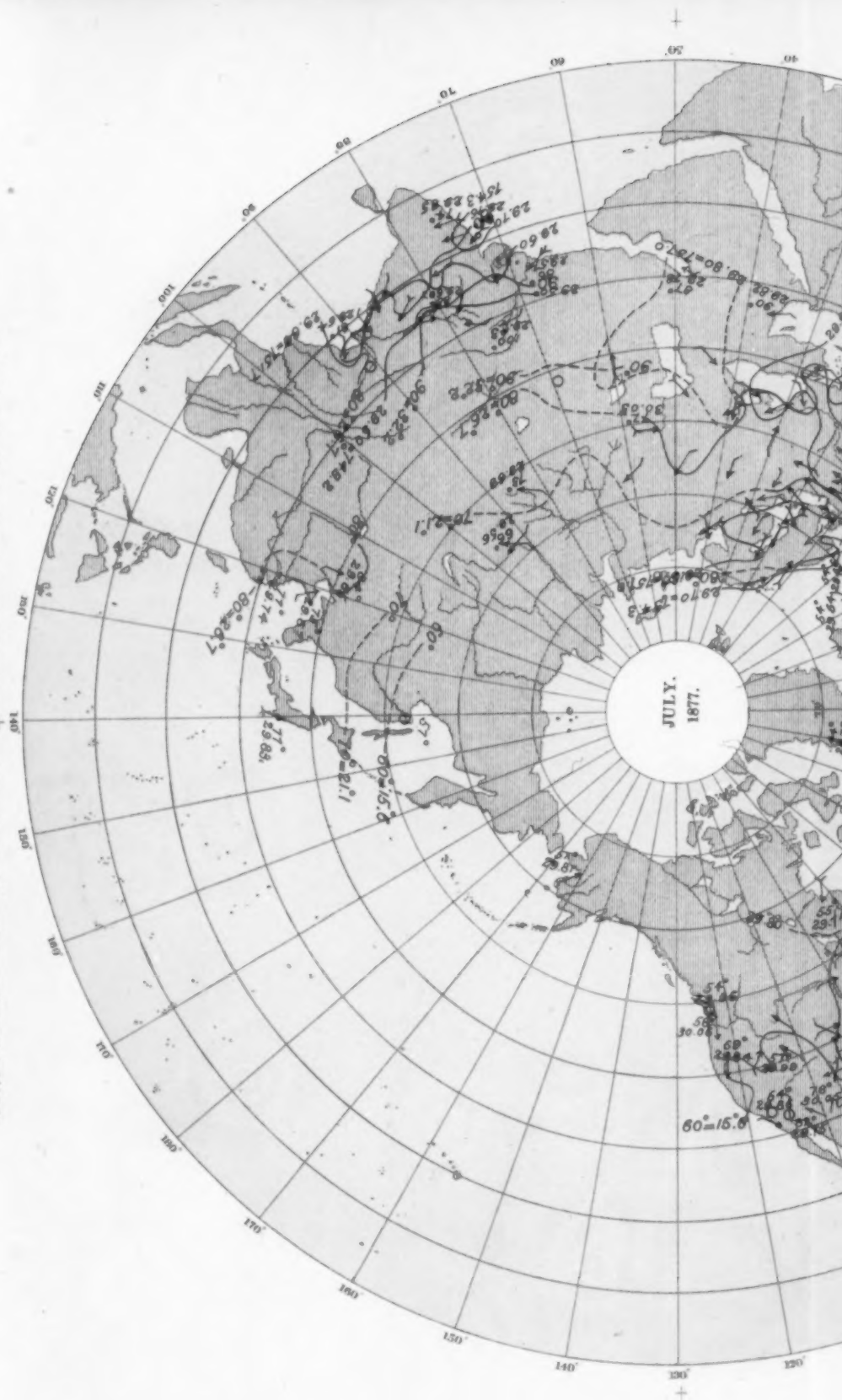
BY ORDER OF THE SECRETARY OF WAR.  
 J. M. [Signature]  
 CHIEF SIGNAL OFFICER, U. S. A.

**Office of the Chief Signal Officer,**

**UNITED STATES ARMY.**

**Charted from Actual Observations taken Simultaneously, Series commencing January, 1877.**

No. V.







#### PREVAILING WINDS.

Arrows show the direction of, and fly with, the wind.  
Force is shown as follows:

SYMBOLS.	FORCE.	VELOCITY.	
		Miles per hour.	Metres per second.
↑	1, 2	0 to 9	0 to 4.0
↑↑	3, 4	9.1 to 22.5	4.1 to 10.1
↑↑↑	5, 6	22.6 to 40.5	10.1 to 18.1
↑↑↑↑	7, 8	40.6 to 67.5	18.1 to 30.2
↑↑↑↑↑	9, 10	67.6 up.	30.2 & over.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR

*W. H. H. H.*

Brig. & Col. Maj. Gen'l,  
Chief Signal Officer, U. S. A.

ISOBAES AND ISOTHERMS.  
Isobars in blue; detached barometer means  
in English inches.  
Isotherms in red; detached temperature  
means in degrees Fahrenheit.  
Broken lines, are doubtful.

#### INTERNATIONAL MONTHLY CHART.

Showing mean pressure, mean temperature, mean force and prevailing direction of winds at  
7:30 A. M., Washington mean time, for the month of July, 1877, based  
on the daily charts of the International Bulletin.

**Office of the Chief Signal Officer,**

**UNITED STATES ARMY.**

**Charted from Actual Observations taken Simultaneously, Series commencing January, 1877.**

No. V.





#### PREVAILING WINDS

Arrows show the direction of, and fly with, the wind.  
Force is shown as follows:

SYMBOLS.	FORCE.	VELOCITY.	
		Miles per hour.	Meters per second.
↑	1, 2	0 to 9	0 to 4.0
↑↑	3, 4	9.1 to 22.5	4.1 to 10.1
↑↑↑	5, 6	22.6 to 40.5	10.1 to 18.1
↑↑↑↑	7, 8	40.6 to 67.5	18.1 to 30.2
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Brig. & Bvt. Maj. Gen'l,  
Chief Signal Officer, U. S. A.

**ISOBARS AND ISOTHERMS.**  
Isobars in blue; detached barometer means in English inches.  
Isotherms in red; detached temperature means in degrees Fahrenheit.  
Broken lines, are doubtful.

#### INTERNATIONAL MONTHLY CHART.

Showing mean pressure, mean temperature, mean force and prevailing direction of winds at 7:35 A. M., Washington mean time, for the month of August, 1877, based on the daily charts of the International Bulletin.



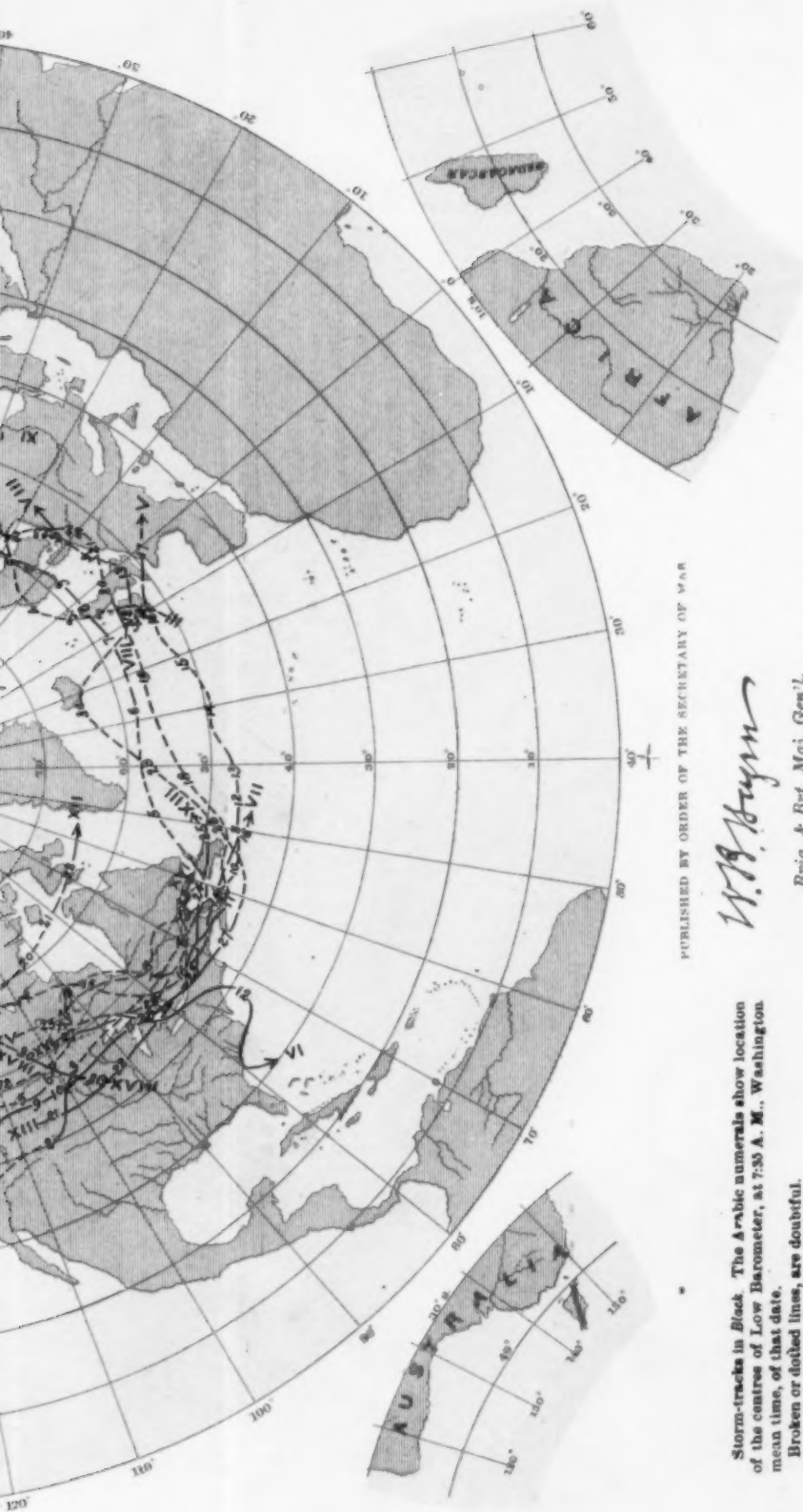
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**Charted from Actual Observations taken Simultaneously, Series commencing January, 1877.**

No. VI.





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*W. H. Bayne*

Brig. & Bvt. Maj. Gen'l,  
Chief Signal Officer, U. S. A.

Storm-tracks in Black. The Arabic numerals show location of the centres of Low Barometer, at 7:30 A. M., Washington mean time, of that date.  
Broken or dotted lines, are doubtful.

INTERNATIONAL CHART.  
Showing Tracks of Centres of Low Barometer for  
July, 1879.